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THE FISHERMAN'S SHARE

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Marine Fisheries Review

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Cover.—In 1971, the fisherman's share of the retail price paid for seafood products was almost 37 percent; the rancher's share of the retail price paid for beef was 65 percent. Beginning on the opposite page, NMFS economist Erwin S. Penn discusses these differences and also differences between different fishery products. The photograph of the cattle ranchers is by courtesy of the Agricultural Extension Service, University of California.

U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

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During 1968-1971, retail prices of fish products rose faster than beef or poultry prices. Here an economist discusses where the money goes.

Price Spreads of Fish Products Among Producers and Distributors

ERWIN S. PENN

ABSTRACT

The rapid increase of fish prices has recently caused public concern. To find the cause of the difference between the price the fisherman receives for his product and the ultimate price paid by the consumer, this report provides an analysis of how the consumer's dollar is distributed to four marketing levels: fisherman, processor, wholesaler, and retailer.

The difference or margin between selling and purchasing prices of each level and the share of the consumer's dollar by each level and each cost component are calculated for 14 fish products. The report also analyzes the costs and profits incurred by each marketing function and describes the major influences on margin differences.

The purpose of the study is to provide a systematic guide that individual firms in the fishery can use to examine their margins, costs, and profits for each fish product, and compare them with the figures presented in this study as national averages for the same product.

INTRODUCTION

Although fish is not the dominant item in food budgeting for the average American, it is important to those who desire a balanced diet by virtue of its nutritive qualities. Consumers are as concerned about prices of fish as they are about other food items. Retail prices for edible seafood products increased 28 percent in the United States during 1968-71, while beef prices increased 20 percent and poultry prices, 6 percent, in the same period (Figure 1). Despite the price freeze in late 1971, both consumers and advocates of consumer protection remain concerned over the high prices already reached for fish products. A close examination of fish pricing by each marketing level seems necessary.

Selected for this study are four groundfish fillets (cod, haddock, flounder, and ocean perch), halibut and salmon in steak and dressed forms, canned salmon and tuna, and four shellfish products (blue crabs, American lobsters, sea scallops, and shrimp). Their production accounts for 36 percent of total fish harvested in the United States in 1971 on a round-weight basis.

Erwin S. Penn is an economist, Economic Research Division, NMFS, Washington, DC 20235.

AUTHOR'S NOTE

Price data of this study cover the period 1950-71 for finfish and 1959-71 for shellfish. The report does not include the prices later than 1971 because prices at the processor's level of different fish products have not been published since then. As a result of an unparalleled pattern of price variations that developed in 1972 and the early part of 1973, price relationships among various marketing levels (other than the processor's) tend to be different from those projected in the present study. The deviation is striking in the price relationships among different levels during Phase II of price controls when the prices at the ex-vessel level were not frozen but those at other levels were.

The trends established in this study are influenced by more recent developments. The relaxation of price control in early 1973, the price ceiling imposed on meat products shortly afterward, and other proposals in the wind would serve to create further disparities between the meat farmer's share of the consumer's dollar and the fisherman's share.

Also, fish products consumed in the United States have a higher percentage of imports than most other major food products. The devaluation of the U. S. dollar twice during the recent period not covered by this study has, therefore, a bullish effect on the prices of fish products, especially at the wholesale and retail levels.

Bearing the above qualifications in mind, readers will be able to reconcile the results of this study with the newly developed situation.

ERWIN S. PENN

Washington, D.C.
March 1973

Price Spread

The differences between the prices charged by the producer and those paid by the consumer can be explained by price spreads. For a fish product, the

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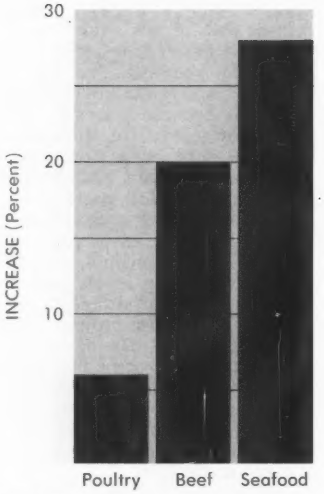

Figure 1.—From 1968 to 1971, retail prices for seafood products increased almost five times as much as those for poultry, and almost half as much more than those for beef.

price spread is the difference between the price paid for the final product by the consumer and the dock side value of an equivalent weight of the product. This difference includes the payments received by all agents performing services in moving fish products from fishermen to consumers. These services include handling (landing), processing, storage, transportation, wholesaling, and retailing.

From dockside to retail the spread is composed of margins at various levels. The difference between the retail price and the cost of the product to the retailer (or price paid to the wholesaler) is called the retail margin. The difference between the price charged by the wholesaler and the cost of purchase from the processor is called the wholesale margin. In the same manner the processor's margin can be estimated from what was paid at dockside and the price received from the wholesaler. Prices at the four levels were collected for most of the selected fish products over the period 1950-71.[1]

[1]Retail prices of some fish products are not available for the 1950's.

Purpose of the Study

Each marketing level contributes some value either by changing the form or place of the product. Each level gets its return for the value added to the final product. To study the contribution of value and to analyze the operating costs at each marketing level would be the first move to determine how effective every sector of the fishery is compared to other industries. To serve as an intermediate objective, this study is designed at this stage to:

1) present estimates of the costs and profits comprising the margins for a number of selected fishery products; and
2) encourage individual firms at each level to review their own operations by comparing their margins with the national averages.

THE FISHERMAN'S SHARE

The fisherman's share in the retail market for finfish varies considerably depending on the products. It averaged from 42.3 percent for halibut steaks to 25.7 percent for canned salmon. The weighted average share in the finfish group is estimated at about 36.6 percent in 1971. This means that, on the average, fishermen received about 37 cents and marketing firms 63 cents of each dollar spent for fresh and canned finfish products by consumers in retail food stores (Figure 2).

The fisherman's share in the shellfish retail market was higher in most cases than that in finfish in 1971. It ranged from 77.9 percent for sea scallop meats to 24.9 percent for blue crab meat. The weighted average share in the shellfish market was almost 47.4 percent. In other words, fishermen received about 47 cents and distribution channels 53 cents of each consumer dollar spent for shellfish products.

Variation Over Time

The fisherman's share in the finfish market varied considerably during the 22 years after 1950. When we examine the historical series of the fisherman's share in groundfish products, greater shares—around 40 percent—are found during the early 1950's (Table 1). This greater share could be attributed to lower marketing costs due to less services involved, cheaper materials used in packaging, and lower freight rates. At the harvesting level, on the other hand, less efficient methods in fishing were practiced in earlier years before the rapid transition to trawling and the extensive use of electronic equipment, such as fish finders, depth indicators, and automatic steering. The unit cost at the ex-vessel level was, therefore, raised while prices at the retail level stayed stable and competed with imports.

During the period 1954-65, the fisherman's share in groundfish products was depressed somewhat in certain years. The downturns during this period almost coincide with the recession years 1954-55, 1960-61, and 1964, when ex-vessel prices dropped more noticeably than retail prices.

The rise of the fisherman's share in groundfish products to above 39 percent after 1966 could be explained by the following: (1) the rapid growth in the size and sales of supermarkets since 1963 has lowered marketing costs; (2) centralization of purchases by chain stores has tended to reduce invoice costs; and (3) increasing imports of fish products have exerted more pressure on retail prices than on ex-vessel prices in the domestic market.

The fisherman's share in canned tuna retail prices was greater than in canned salmon in all the years since 1950. One reason for this was that the amount of canned tuna at the retail level was more than double that of canned salmon. Half of the tuna supply in the U.S. market was imported at a lower price. The average price spread of canned tuna was, therefore, reduced, which tends to increase the fisherman's share. Second, the production season for salmon historically has been shorter than for tuna, and the domestic market for salmon is not supplemented by imports as it is for canned tuna. Thus

Table 1.—Fisherman's share of consumer's dollar for finfish products compared with farmer's share of the same for beef, pork, and market basket foods, 1950-71.

Year	Fisherman's share: Fresh cod, flounder, haddock fillets	Fisherman's share: Frozen ocean perch fillets	Fisherman's share: Salmon steaks (fresh)	Fisherman's share: Halibut steaks (fresh & frozen)	Farmer's share[1]: Canned fish: Pink salmon	Farmer's share[1]: Canned fish: Tuna (chunk)	Farmer's share[1]: Beef (choice grade)	Farmer's share[1]: Pork	Farmer's share[1]: Market basket of foods[2]
	Percent								
1950	39.5	N.A.	N.A.	N.A.	27.7	N.A.	74	64	47
1951	40.7	N.A.	N.A.	N.A.	33.2	N.A.	77	63	49
1952	40.1	31.7	N.A.	N.A.	28.0	N.A.	74	60	47
1953	37.6	29.5	N.A.	N.A.	29.4	33.0	66	67	44
1954	35.1	30.9	N.A.	N.A.	28.1	34.0	68	65	43
1955	35.4	29.2	N.A.	N.A.	30.2	32.5	66	54	41
1956	35.5	30.1	N.A.	N.A.	25.7	33.0	65	52	40
1957	37.3	29.7	N.A.	N.A.	31.2	32.4	65	55	40
1958	39.8	30.9	N.A.	N.A.	24.4	33.5	67	58	40
1959	39.7	29.4	N.A.	N.A.	30.7	32.1	66	46	38
1960	34.2	29.7	N.A.	23.4	32.7	34.0	65	51	39
1961	32.4	27.7	N.A.	29.0	22.7	32.4	62	52	38
1962	33.2	28.6	N.A.	35.5	30.9	34.0	68	51	38
1963	33.5	30.3	N.A.	24.5	25.9	29.6	62	48	37
1964	31.2	27.4	N.A.	30.1	24.9	31.8	60	48	37
1965	32.2	26.7	N.A.	34.9	25.7	32.6	65	58	39
1966	35.3	30.7	N.A.	38.4	[3]	32.8	63	57	40
1967	35.3	24.1	39.8	31.8	[3]	30.0	64	52	38
1968	34.6	23.4	36.4	34.3	[3]	38.9	65	51	39
1969	39.5	25.9	34.5	52.9	[3]	39.8	65	55	41
1970	42.3	26.3	N.A.	47.5	[3]	39.3	63	50	39
1971	41.2	23.4	34.0	42.3	[3]	40.1	65	45	38

[1]Compiled by the U.S. Department of Agriculture.
[2]Include meat products, dairy products, poultry, eggs, bakery and cereal products, fresh fruits, fresh vegetables, processed fruits and vegetables, fats and oils, and miscellaneous products—farm-originated food products purchased annually per household by wage-earners and clerical worker families and single workers living alone. Meals in eating places, imported foods, seafoods, and foods not of farm origin are excluded.
[3]Series discontinued by the Bureau of Labor Statistics.

Table 2.—Fisherman's share of consumer's dollar for shellfish products, 1959-71[1].

Year	Fisherman's share: Sea scallop meat	Fisherman's share: Frozen raw peeled shrimp	Fisherman's share: Live American lobsters	Fisherman's share: Blue crab meats
	Percent			
1959	53.8	36.3	49.1	39.2
1960	44.8	40.8	46.2	26.7
1961	49.3	44.8	45.5	28.6
1962	52.2	47.0	44.9	27.9
1963	55.1	36.5	50.8	25.6
1964	56.3	44.4	54.7	28.3
1965	59.1	43.6	51.1	29.9
1966	50.8	48.5	51.6	27.0
1967	63.8	39.8	54.6	23.0
1968	64.0	45.2	[2]	29.3
1969	66.0	45.4	[2]	26.0
1970	72.3	43.2	[2]	21.5
1971	77.9	49.9	[2]	24.9

[1]Retail prices of most shellfish products are not available for the years before 1959.
[2]Series discontinued since 1968.

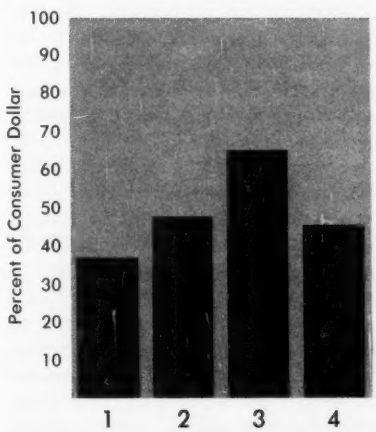

Figure 2.—In 1971, the fisherman's share of the consumer's dollar averaged 36.6 percent for finfish, 47.4 percent for shellfish. For comparison, the farmer's share for choice beef was 65 percent, for pork 45 percent (see Table 1). The scale of operations appears to account for some of these differences: about 10 times as much beef, about 6 times as much pork, are consumed as seafood products.

salmon have higher storage costs and a greater risk of price declines during the marketing period.

During the 13 years 1959-71, the fisherman's share for shellfish increased in three products—sea scallops (2.2 percent a year), live American lobsters (14 percent a year), and frozen raw peeled shrimp (0.5 percent a year)—and declined in blue crab meats (−0.7 percent a year).

The fisherman's share in the shrimp market showed a distinct upward trend following the pattern of consumption. Shrimp consumption increased at the rate of 5.6 percent a year during the 5 years 1967-71, whereas retail prices, after adjustment to constant value, stayed stable. As ex-evessel prices, after value adjustment, continued to increase during this period, the fisherman is bound to get a bigger share in the retail market.

Ex-vessel prices of sea scallops and live American lobsters increased faster than retail prices over the years since 1959. The increase has raised the fisherman's share in these two products in recent years.

The decline in the fisherman's share in blue crabs is attributed to a different reason. Blue crab meat processing is labor intensive, and its costs increase more rapidly than the expenses in harvesting.

Comparison With the Farmer's Share

The weighted average of the fisherman's share was 47.4 percent of shellfish retail prices in 1971 and compared favorably with 38 percent of the farmer's share in the market basket of 63 food items compiled by the U.S. Department of Agriculture in the same period (Tables 1 and 2).

But the fisherman's share of 36.6 percent in the finfish market was much lower than the farmer's share in the beef market (65 percent) and the pork market (45 percent). Beef and pork are sold in large quantities in the market. Compared with fish products, beef consumption averaged about 10 times greater and pork consumption 6 times

greater during 1969-71. To handle the big quantities of meat products, each meat packing plant is operated on a much bigger scale and with more automation than a fish processing plant. It is likely that meat packing has an edge over fish processing in being able to lower packing and marketing costs because of economies of scale (National Commission on Food Marketing, 1966). In the retail market fish are not sold in as large quantities as meat. Owing to bigger quantities in the sale of meat, meat prices, particularly beef prices, are more often offered by retail stores as the "price leaders" to attract customers. Beef and pork prices are, therefore, cut to the lowest possible levels (National Commission on Food Marketing, 1966b). This reduces the margins on beef and pork sales and raises the farmer's share accordingly.

TREND OF PRICE SPREADS OF FISH PRODUCTS

The price spread of a food product can be divided into as many margins as there are ownership transfers and available price information. In this study, the prices of each fish product are gathered at four levels—ex-vessel, processing, wholesale, and retail.

Ex-vessel Prices[2]

When prices at all levels are adjusted to constant dollar value[3], ex-vessel prices since 1950 trended upward for some species, particularly cod, haddock, sea scallops, and American lobsters, and downward for ocean perch and tuna. Because of changes in stocks or runs[4], ex-vessel prices of flounder, halibut, king salmon, blue crab, and shrimp fluctuated annually without a discernable trend. Better harvesting years command lower ex-vessel prices.

Price margins for most fish products were relatively large at the ex-vessel level because of high wage costs. Over two-fifths of gross earnings was spent on labor and about one-fifth on capital costs.

Processor's Margin and Markup

Price margins at the processor's level for most fish products were as large as those at the ex-vessel level because processing is rather labor intensive. Processor's prices, after adjustment to constant dollar value, increased slightly for most of finfish products during the last two decades and for shellfish during the last decade. Exceptions to this observation were canned tuna, fresh flounder fillets, and frozen ocean perch fillets.

The decline of processor's prices usually followed the drop of ex-vessel prices. If the ex-vessel price of one product dropped more than the processor's price, the processor's margin increased despite the fact that the price he asked declined. In comparing the margins at different levels of one product and those among different products over a period of time it is more convenient and better understood to express the differences in relative instead of absolute values. When the processor's margin is divided by the processor's price the result is the value of markup interpreted as the gross profit in percent of the processor's sales, or simply the gross profit rate.

During 1969-71 gross profit rates at the processor's level were highest for ocean perch fillets (52.3 percent) among groundfish products, highest for fresh king salmon steaks (39.5 percent) among dressed and steak forms of fish products, and higher for canned pink salmon (56.9 percent) than canned tuna.

Over the past 20 years, gross profit rates for fresh cod fillets, fresh flounder fillets, halibut steaks, and fresh blue crab meat increased slightly at the processor's level, while canned tuna and fresh haddock fillets declined and canned pink salmon, frozen ocean perch fillets, and raw peeled shrimp remained almost unchanged.

The processor's markup, as will be seen later, is in most instances higher than the wholesale level. About 55 to 60 percent of the processor's margin is labor and material costs which increased faster than the overhead costs. In addition, the amount spent for food product advertising increased even faster than wage costs. These expenses are incurred by the processor when the products bear the manufacturer's name.

Wholesale Margin and Markup

In most instances, retail prices are subject to lesser fluctuation than are ex-vessel prices. Since retail prices are relatively stable, it follows that somewhere in the channels of distribution, market margins must be reduced (raised) when ex-vessel prices rise (decline).

Prices at the wholesale level fluctuated more distinctly and moved upward for most fish products except that wholesale prices of canned tuna and ocean perch fillets declined slightly and those of canned pink salmon and fresh flounder fillets remained more or less constant.

An increase in wholesale price does not necessarily imply that the wholesale margin over the processor's price has increased. During 1969-71, wholesale markups (gross profit rates) for packaged and canned fish products are estimated around 15 to 16 percent, with the exception of American lobsters (36 percent) and fresh king salmon steaks (29.4 percent[5]).

Although wholesale prices increased, wholesale margins remained relatively stable. A similar increase in whole-

[2]Ex-vessel prices are the prices agreed upon between the seller, the fisherman, and the buyer, the wholesaler or processor, at the dockside for the exchange of certain amount of fresh fish landed by the fisherman on a per pound basis.

[3]The constant dollar value of a commodity at any market level is one when the current price of the commodity is adjusted to a value as if the price has not risen due to inflation compared with a certain period as the base year. The adjustment is made by dividing the actual prices of the commodity in a time series by the corresponding indexes from the implicit price deflator series for non-durable goods. In this study we use 1967 as the base year.

[4]Stock refers to the resource available for each species. Run refers to the act of a fish to migrate or ascend a river to spawn.

[5]Wholesale margin of American lobsters is larger than other fish products because they are sold live and heavy transportation costs are assumed by the wholesalers. Part of fresh salmon steaks is shipped by air freight, the costs of which are paid by the wholesalers.

saler's cost of sales, i.e., processor's prices, equalized the margins at the wholesale level over the period.

Retail Margin and Markup

Price margins at the retail level for some fish products are as large as at the ex-vessel level. For the last two decades retail prices of most fish products under our study, after adjustment to constant value, fluctuated slightly with a mild upward trend. Prices of canned tuna and halibut steaks, however, were declining. Those that showed an abrupt change in price movements, particularly during the years 1969-71, were fresh flounder fillets and fresh haddock fillets with a sudden retail price upturn and fresh sea scallops and blue crab meat with a sudden drop in retail prices. While most retail prices, after they are deflated, were moving upward, the gross profit rates of fish retailers increased slightly only in four products—canned pink salmon, fresh flounder fillets, frozen ocean perch fillets, and fresh blue crab meat, markups for halibut steaks and fresh sea scallops declined drastically while markups for the rest dropped slightly during the period covered in our study.

A retail food store is a multiproduct firm which handles thousands of food and nonfood items simultaneously. Costs are allocated not separately to each individual commodity but to a product-mix of a group of related commodities. Less emphasis is placed on profit margins of individual commodities, as the pricing strategy of a retail store is focused on the maximization of the overall profit of the entire store.

The rigidity of such a pricing practice of each retail store causes the retail price of each item to be less responsive to the cost of sales. As a result, the retail margin narrows in the short run as wholesale prices advance.

The average rate of markups at the retail level is somewhere between those at the processing and wholesale level. During 1969-71 retail markups were relatively high for most groundfish (34-37 percent) except fresh haddock fillets (17 percent). Markups for blue crab meat and canned fish products ranked next between 24 and 28 percent; while those for fish steaks, sea scallops, lobsters, and peeled shrimp were around 20 percent.

The overall average of retail markups of different fish products were about 63 percent higher than wholesale markups during 1969-71. In some instances, they rose to double the rate of the latter. The following reasons account for the higher markup rate at the retail level:

1. Most fish products are sold by retailers in quantities of less than 10 pounds in each transaction, whereas they are disposed of at tens of thousand pounds in each dealing at other levels.

2. Higher operating and overhead costs per unit sold are incurred at the retail level. About 67 percent of retail costs is operating expenses that include mostly salaries of salesmen attending the fish counter.

3. Spoilage and shrinkage increase progressively as fish products are distributed through marketing channels from the dockside to the consumer. The greatest loss is assumed by the retailer. Most of our retail prices are collected from New York City, where the weight loss due to spoilage and shrinkage was 5.3 percent in winter and 6.0 percent in summer—about 1.9 and 2.2 times higher respectively than at the wholesale level (Bureau of Commercial Fisheries, Marketing Division, 1966).

4. Retailers pay about 1.5 cents per pound in winter and 2.0 cents per pound in summer for quality control of fish products on items such as ice, refrigeration, chemical additives, glazing, brine, and other treatments—about 15 percent higher than the amount paid by producers and distributors for the same purpose (Bureau of Commercial Fisheries, Marketing Division, 1966).

Despite the high costs involved in retailing fish products, retail markups for most fish products trended downward during the last decade for shellfish (except blue crab meat), and during the last two decades for groundfish (except flounder and ocean perch fillets) and canned fish products (except salmon).

Fish products with a relatively high unit price usually have low retail markups. Overhead costs are often allocated to products not according to their value but to the volume of floor space occupied. High-priced peeled shrimp, live lobsters, sea scallops, and halibut and king salmon steaks illustrate this observation. Those products that have easily discernable quality and are purchased relatively frequently by consumers are also given low retail markups because of the large turnover of their sales. That is one of the reasons why canned tuna retail markups dropped rapidly for the last 4 years.

Comparison of Price Changes at Retail Level With Those at Other Levels

As was indicated in the discussion of retail food market behavior, retail prices moved upward without much fluctuation as did prices at other levels. The trend of retail price movements reacts with price trends at other marketing levels differently from one product to another. A comparison of the price movements of the four levels over the last two decades can be summarized as follows:

1. Products whose retail prices increased at a slower rate than prices at the other three marketing levels are:
   a. halibut steaks and fresh sea scallops (distinctively slower);
   b. fresh haddock fillets, raw peeled shrimp, and live American lobsters (moderately slower); and
   c. canned chunk tuna (slightly slower).

2. Products whose retail prices increased at a faster rate than at the other three marketing levels are:
   a. fresh flounder fillets (moderately faster), and

b. canned pink salmon, frozen ocean perch fillets, and fresh blue crab meat (slightly faster).

3. Only one product, fresh cod fillets, saw its retail prices increase at about the same rate as prices at other levels.

COSTS AND PROFITS—THE COMPONENTS OF PRICE SPREADS

To develop a better understanding of price spreads and their variation between products and between marketing levels of each product, it is necessary to examine the services performed in getting the fish products from dockside to the retail market and the costs and earnings involved in performing these services at each level. Each category of costs differ among different marketing levels, e.g., labor is less involved in the wholesale level than in processing and harvesting levels. The cost components and net profits (or losses) for different levels are compiled from summary tables and statements published by Business Income Tax Return Statistics (U.S. Internal Revenue Service, 1967), Supermarket Financial Statements (Supermarket Institute, Inc., 1965), Detailed Statistics on Canned Seafoods, Fresh and Frozen Packaged Fish (Census of Manufactures, 1967), and numerous individual cost studies for specific fish products. Costs and receipts of different fishing vessels are compiled by the NMFS Economic Research Division.

The information and data so collected for marketing levels are processed and then reduced to ratios expressed as percentages of the margin at each of the four levels—harvesting (fishing), processing, wholesaling, and retailing as shown in Tables 3 and 4. These ratios are used as bases to allocate the costs to each fish product according to the actual margin calculated from price studies at each level (Table 5 and Figure 3).

DIVISION OF CONSUMER'S DOLLAR SPENT ON FISH PRODUCTS

Prices of fish products are expressed in cents per pound. They can be converted to pounds per dollar at the retail level, i.e., the value of a consumer food dollar. A consumer's dollar spent for each fish product can be sliced many ways. It can be divided according to marketing functions to show how much the fisherman, processor, wholesaler, and retailer earn of each dollar spent by the consumer. The share of a consumer's dollar can also be distributed according to costs spent by the four functions to show how much goes to labor, materials, capital expenses, operating expenses, and net profit in the production and marketing of each fish product. A different comparison is offered here to evaluate the services rendered and profits earned by all the functions involved in bringing each fish product to the consumer market (Table 6 and Figure 4).

It is observed that, in general, market margins (except at the harvesting level) tend to be proportionally higher for lower priced fish products as labor and overhead expenses are fixed for all products regardless of their differences in value. Ocean perch fillet is an example among the groundfish. By the same token, margin ratios for halibut steaks (cheaper in price) are higher than those for fresh king salmon steaks (more expensive) at all levels except the wholesale level. The consumer pays more out of his food dollar at the wholesale level for fresh king salmon steaks, because a large part of their shipment was delivered by air-freight from Seattle by the wholesaler. This tends to inflate the wholesale margin of salmon steaks.

Prices of shellfish are generally higher than those of finfish products on a meat weight basis. Higher priced prod-

Table 3.—Cost rates, as percentage of price margin, at different market levels.

	Margin	Materials & fuels	Labor	Capital costs	Operating expenses	Net profit
			Percent			
I. Retail:						
a) Supermarket[1]	100.0	4.1	6.3	16.9	63.6	9.1
II. Wholesale:						
a) Food & kindred products[2]	100.0	14.8	6.1	9.2	45.4	24.5
b) American lobster (live)[3]	100.0	23.0	13.0	7.0	47.0	10.0
III. Processing:						
a) Fresh & frozen packaged fish[4]	100.0	36.5	22.2	7.8	25.3	8.2
b) Canned & cured seafoods[4]	100.0	34.3	19.9	9.7	29.6	6.5
c) Food & kindred products[1]	100.0	21.3	11.2	9.0	44.0	14.5
d) Peeled shrimp[5]	100.0	27.0	33.2	9.3	22.5	8.0
e) Blue crab meat[6]	100.0	25.3	44.2	2.2	21.3	7.0
IV. Wholesale and processing combined:						
a) Scallop & oyster[7]	100.0	20.2	13.2	9.6	45.0	12.0

[1] Published by Supermarket Institute, Inc., 1965.
[2] *Business Income Tax Return Statistics*, Internal Revenue Service, 1967.
[3] Derived from the *Joint Master Plan for the Northern Lobster Fishery*, BCF, Department of the Interior, April 1970.
[4] *Census of Manufactures*, U.S. Department of Commerce, 1967.
[5] Survey of the U.S. Shrimp Industry, Vol. 1, Fish and Wildlife Service, Special Scientific Report—Fisheries No. 277, U.S. Department of Commerce, 1954.
[6] Derived from discussions with the staff in the Market Research and Services Division, NMFS, Department of Commerce.
[7] Derived from figures and information given in *Culture, Handling and Processing of Pacific Coast Oysters*, Bureau of Commercial Fisheries, 1960.

ucts enjoy higher profit in monetary terms but lower profit rate against sales in relative terms. This applies to shellfish products. Conversely, profit rates for finfish products generally ranked higher than those for shellfish products.

CONCLUSIONS

Dividing each price spread into margins at different functional levels and breaking each margin down into component costs and profits to examine them in depth are the first steps toward evaluating the effectiveness of a marketing system.

Over half of the margin at the harvesting level is labor cost. Wage rates have been increasing faster than most costs, and this trend is likely to continue. The slow recruitment of resources of certain species and the lag in harvesting efficiency in some fisheries (Bell, 1971) will further accelerate the increase in ex-vessel prices or fishermen's margin compared to other levels.

Component costs at the wholesale level are mostly administrative. Margins at this level will increase much slower than at the ex-vessel level, although wholesale price will increase according to the price charged by the processor.

Processor's costs are comparatively less involved in labor than fishing vessels but more than at the wholesale and retail levels. Processor's margin tends to rise at a pace between the rates of increase in wholesale and ex-vessel prices.

At the retail level, observations made at the variation of margins for different products have born out the expectation that:

1) margins vary directly with the perishability of products and the distance of shipment;

2) margins vary inversely with the rate of turnover, the level of unit price, and the amount of imports of identical products; and

3) retail margins are higher on manufacturers' brands than on private brands.

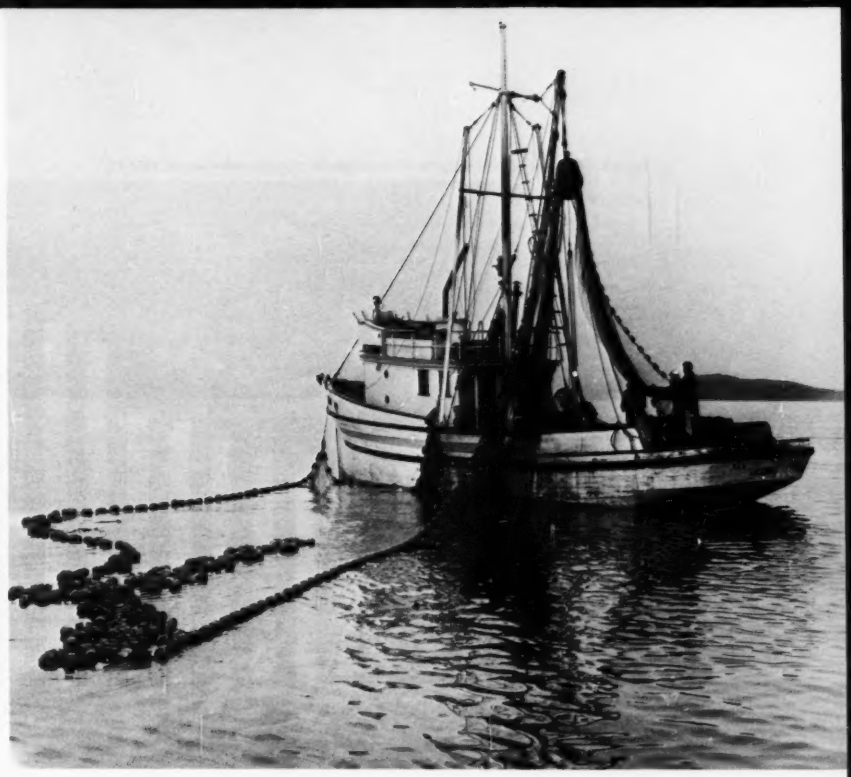

Figure 3.—In the late 1960's, salmon purse seiners earned the highest net profit (16.1 percent) of any of several common types of U.S. fishing vessels. At the bottom were Boston large trawlers (4.3 percent, 1964-66) and New Bedford sea scallop draggers (4.5 percent, 1967-68). (See Table 4.)

Table 4.—Cost rates, as percentage of gross receipts, for different fishing vessels at the harvesting level. (Average of 3 years—1966-68, unless otherwise marked.)

	Gross receipts	Materials fuels, etc.	Labor	Capital costs	Operating expenses	Net profit
1. Boston large trawler (1964-66)	100.0	19.6	47.2	16.6	12.3	4.3
2. New Bedford dragger (1967-68)	100.0	18.6	47.0	18.0	11.3	5.1
3. Rhode Island small trawler (1964)	100.0	16.1	47.1	21.1	7.1	8.6
4. Halibut vessel	100.0	18.5	36.6	21.4	12.0	11.5
5. Salmon troller	100.0	12.5	32.5	31.8	11.1	12.1
6. Salmon purse seiner	100.0	9.8	39.0	21.8	13.2	16.1
7. Tuna purse seiner	100.0	13.2	41.5	25.2	13.1	7.0
8. American lobster inshore boats with traps (1966)—same for blue crab traps[2]	100.0	16.3	43.1	9.8	28.4	6.0
9. Gulf shrimp otter trawler	100.0	13.9	37.6	16.6	25.5	6.4
10. New Bedford sea scallop dragger (1967-68)—same for oyster dragger	100.0	14.5	[3]48.0	15.8	17.2	4.5

[1] Salmon troller earnings and costs for 68 vessels surveyed by the Division in 1968.
[2] *Estimation of the Economic Benefits to Fishermen, Vessels, and Society from Limited Entry to the inshore U.S. Northern Lobster Fishery*, draft manuscript by Frederick Bell, March 1970.
[3] Shucking done on boat.

Source: *Basic Economic Indicators*, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 1970.

Table 5.—Average annual margins of fish products at four market levels, 1969-71.

Products	Harvesting	Processing	Wholesale	Retail
		Cents per pound		
Groundfish fillets:				
Fresh:				
Haddock	67.75	22.28	8.69	21.38
Flounder	43.79	26.07	14.80	44.73
Cod	36.93	26.69	9.95	31.60
Frozen:				
Ocean perch	15.87	14.37	9.89	23.64
Steaks:				
Halibut	49.92	25.53	9.35	20.50
King salmon	57.91	37.66	39.50	33.91
King salmon (dressed)	52.17	33.93	35.60	30.53
Canned products:				
Salmon (1963-65)[1]	18.17	21.47	8.58	23.41
Tuna, chunk (1963-65)[2]	24.77	23.85	9.58	15.77
Tuna, chunk (1969-71)	38.81	28.64	11.24	19.04
Fresh shellfish products:				
Live American lobster	77.52	[3]	43.52	26.63
Blue crab meat	56.88	88.34	23.36	65.75
Sea scallop meats	131.60	[4]	13.57	36.74
Frozen shellfish products:				
Peeled shrimp	110.62	49.90	32.87	46.07

[1] Figures not available in later years.
[2] Use the same period to compare with salmon.
[3] Sold live.
[4] Landed shucked.

When price spreads of different periods are compared, the year-to-year changes are ascribed to one or more of the following seven factors: (1) demand and supply, (2) cost of production factors, (3) different profits made by producers and dealers, (4) degree of processing and extent of services, (5) quantity of imports, (6) revaluation of currency, and (7) efficiency of the marketing system.

Precise measurement of the last factor is possible only for individual firms on a case by case basis. Detailed micro data are needed for such a purpose. They were not collected since they are not suitable for the macro analysis of an industry on an aggregate or national basis as the case is in this study.

Individual fish dealers at either the producing or distributing level, however, will have a chance to identify whether there is room for improvement in their performances by examining and comparing the magnitude of their margins, component costs, and profits with those of similar products presented in this report as national averages.

Table 6.—Distribution of consumer's dollar spent in various fish products in the United States according to the average prices of 1969-71, by marketing functions and cost items.

	Fresh haddock fillets	Fresh flounder fillets	Fresh cod fillets	Frozen ocean perch fillets	Halibut steaks (fresh & frozen)	Fresh king salmon steaks	Dressed fresh king salmon	Canned pink salmon[1]	Canned tuna chunk[1]	Canned tuna chunk	Live American lobster	Fresh blue crab meat	Frozen peeled shrimp	Fresh and frozen sea scallop meats
							Cents							
By marketing functions														
Retailing	17.80	34.57	30.04	37.07	19.46	13.70	9.09	32.68	21.31	19.48	18.03	28.05	19.23	20.19
Wholesaling	7.23	11.44	9.46	15.50	8.87	26.26	27.90	11.97	12.95	11.50	29.47	9.96	13.72	7.45
Processing	18.55	20.15	25.37	22.53	24.24	18.20	24.67	29.87	32.24	29.30	[2]	37.69	20.83	[3]
Harvesting	56.41	33.84	35.11	24.88	47.40	41.83	38.31	25.36	33.48	39.71	52.49	24.27	46.19	72.34
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
By cost items														
Profits at 4 levels: Total	5.99	9.61	9.58	13.32	11.38	11.09	11.23	14.64	9.55	9.06	7.73	8.23	10.78	6.91
Retailing	0.29	3.15	2.73	5.55	1.78	1.56	0.82	5.67	1.94	1.57	1.64	2.55	1.75	1.84
Wholesaling	1.76	3.09	2.31	3.79	2.17	3.52	3.75	2.93	3.17	2.81	2.94	2.44	3.15	1.83
Processing	1.51	1.65	2.08	1.85	1.98	1.72	2.02	1.95	2.09	1.90	[2]	1.78	2.92	[3]
Harvesting	2.42	1.72	2.46	2.13	5.45	4.28	4.64	4.09	2.33	2.78	3.15	1.46	2.96	3.25
Materials and fuels	19.75	16.32	18.63	14.48	19.73	19.73	17.96	15.64	18.27	17.78	16.07	16.12	14.44	12.42
Labor	32.28	22.77	24.32	21.24	24.50	24.50	20.20	18.26	22.44	24.24	27.59	29.50	26.00	36.45
Capital costs	14.82	13.29	12.77	14.62	16.13	16.13	17.12	14.36	16.35	17.20	10.25	9.29	14.24	15.52
Operating expenses	27.13	38.01	34.70	36.25	28.23	28.23	33.49	37.06	33.36	31.48	38.22	36.87	34.94	28.67
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[1] 1963-65 average prices are used here since the retail price series of canned pink salmon was discontinued by BLS in 1966. Prices of the same period are used for canned tuna for comparison.
[2] No processing.
[3] Shucked at sea.

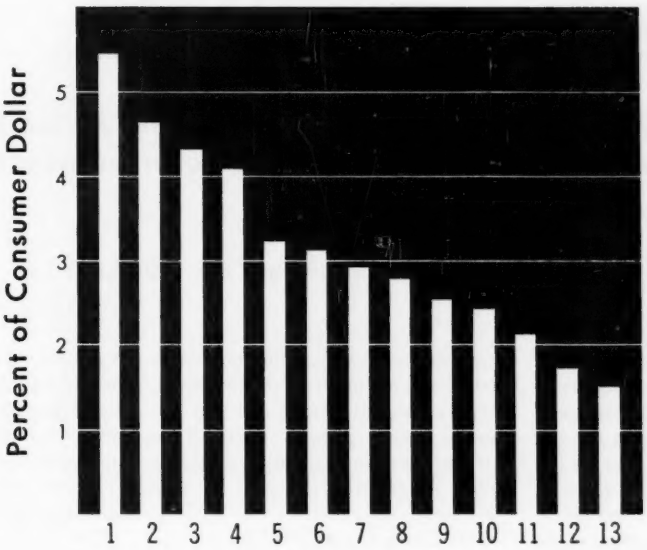

Figure 4.—The percent of the consumer's dollar that went for profits to the fisherman in 1969-1971 ranged from 5.45 for halibut steaks to 1.46 for fresh blue crab meat (see Table 6). 1, halibut steaks (fresh and frozen); 2, dressed fresh king salmon; 3, fresh king salmon steaks; 4, canned pink salmon; 5, fresh and frozen sea scallop meats; 6, live American lobster; 7, fresh peeled shrimp; 8, canned tuna chunk; 9, fresh cod fillets; 10, fresh haddock fillets; 11, frozen ocean perch fillets; 12, fresh flounder fillets; 13, fresh blue crab meat.

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MFR PAPER 988

Rapid Assessment of Ocean Environment Aided by New Shipboard STD Digitizer-Computer Interface

W. JAMES INGRAHAM, JR., and C.J. BARTLETT

As part of the new NMFS Marine Resources Monitoring Assessment and Prediction (MARMAP) Program, oceanographers are searching for key measurements to assist them in providing forecasts of the fisheries. One problem confronting these oceanographers is the rapid, accurate assessment of the ocean environment.

A recent development of interest is the linking of a Plessey Environmental Systems STD (salinity-temperature-depth) data acquisition system to a Digital Equipment Corporation PDP-8 computer[1] aboard the NMFS Northwest Fisheries Center's RV *George B. Kelez*. This involves installation of a digitizer-interface unit and has been accomplished and field-tested by personnel of the Center's Oceanography Program. Because this unit may become standard equipment aboard NMFS research vessels, a complete description is presented here.

Since the origin of reversing water bottles, salinity and temperature measurements at depth have been obtained by positioning several of these bottles (with precision reversing thermometers attached) along a cable at various depths in the ocean. Discrete water samples thus obtained were analyzed for salinity by chemical titrations or, more recently, by electronic (laboratory) salinometers. The details in the temperature and salinity structure with depth depended upon the number of Nansen bottles used. This time-consuming method has recently been supplemented by electronic sensors attached to conductor cables which, as they are lowered into the sea, give continuous analog graphical traces of the termperature and salinity profiles vs depth on recorders in the vessel's laboratory.

This analog system provides a visual display which allows oceanographers to easily locate and follow discrete strata or ocean fronts which may influence the distributions of the plankton or fish. Unfortunately, the time and personnel available for accurate analyses of data during field operations is usually limited and the extraction and correction of specific values of temperature and salinity from these graphs are not only time consuming and laborious but limit the analyses which may be done at sea. Conversion of the analog signals to digital format and processing them by computer eliminates manual processing and permits additional analyses such as field of density and geostrophic ocean currents. Our method of digitizing the signal from the Plessey Environmental System's Model 9006 or 9040 STD and interfacing the unit with a PDP-8 computer is described below.

DESCRIPTION OF HARDWARE AND FUNCTION

Hardware List

The hardware system (Figures 1 and 2) consists of: (1) the basic unit as purchased from Plessey Environmental Systems Model 9006 STD system including the underwater sensors, single conductor 1H025 cable, winch, deck unit with the three channel discriminators, and the analog graphic recorder; (2) the digitizer-interface including three Hewlett-Packard Model 5326C electronic counters, three 27-channel interconnecting cables, a Digital Input Subsystem Type DS80, and a unijunction transistor (UJT) clock of our design; and (3) a Digital Equipment Corporation PDP-8 computer with ASR35 teletype and DECtape 55 for peripheral data input-output equipment.

STD Sampling System and Analog Graphic Record

As the underwater STD unit is lowered slowly at a speed of 30 or 60 m/min to a depth of 1500 m, data are produced in an analog mode in the following manner. The sensors simultaneously produce frequency modulated (fm) signals which are linearly proportional to salinity, temperature, and depth over the respective ranges 4995 to 7901Hz = 25 to 35 ‰, 2127 to 4193Hz = −2.0 to 30°C, and 9712 to 11288Hz = 0 to 1500 m. These fm signals are mixed and transmitted through the single-conductor

[1]Use of trade names in this publication does not imply endorsement of commercial products by the National Marine Fisheries Service.

W. James Ingraham, Jr., is an oceanographer, C.J. Bartlett, an electronic technician, on the staff of the NMFS Northwest Fisheries Center, Seattle Laboratory, Seattle, WA 98112.

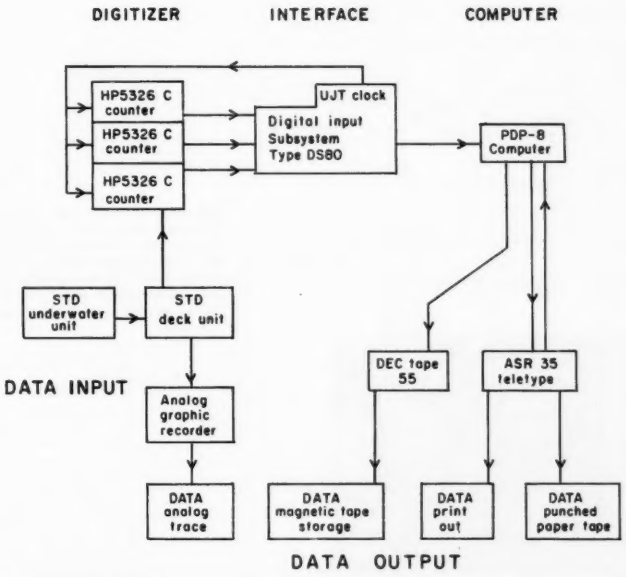

Figure 1.—Block diagram of STD-computer on-line data acquisition and processing system aboard RV *George B. Kelez*, October 1971.

cable to the deck unit where they are separated by discriminators into two branches: a 10 mv dc level or an analog fm. The former drives the X_1, X_2, Y recorder, which produces the graphic results, and the latter is sent to the computer through a digitizer/interface unit.

Digitizer and Data Timer

Three Hewlett-Packard electronic counters (Model 5326C) with BCD (binary coded decimal, 1-2-4-8) output option 003 and a UJT clock digitize, by period averaging, the analog fm salinity, temperature, and depth signals separately for 100 cycles. Time is measured against a 10 MHz oscillator internal time base and the result is a six-digit display available as BCD numbers in TTL (transistor transistor logic) compatible voltages for parallel wiring directly to the DS80 for computer input. Count time for each channel is slightly different—20.0200 to 12.6560 msec for salinity, 23.8490 to 47.0140 msec for temperature, and 10.2965 to 8.8589 msec for depth. This means that in a free running mode the counters will display at least 50 salinity, 21 temperature, and 97 depth readings per second; the readings could be considered instantaneous compared to the rather large time constant of 350 msec for the temperature probe. It is desirable for computational purposes, however, to have three simultaneous readings separated by a fixed time interval; thus an electronic clock was designed to control the sampling rate of the counters. The UJT clock (Figure 3) applies a +5 v to the A-6 assembly of each counter to inhibit them from counting. Timing in the clock is controlled by a resistance-capacitor circuit in which the voltage builds up until the unijunction (2N489) transistor fires. This discharges the capacitor and the process is repeated automatically at a rate which is adjustable between 75 and 750 msec. The unijunction fires a second transistor (2N3393) which pulls the output of the clock from +5 v to 0 v, thus releasing the inhibit for at least 2 μs and allowing the counters to start counting simultaneously. The maximum time to count 100 cycles is 10 msec for depth, 23 msec for salinity, and 47 msec for temperature. At the end of each count the data number is stored and held in the buffer of the counter and a print command (+5v at pin 48 of the BCD plug) is issued. Since the time for the temperature count will always be the longest, only the temperature print command is used to generate a computer interrupt as a signal all three values are available. The maximum rate of data transfer is limited by the setting of the UJT clock; 300 msec was initially cho-

Figure 2.—Laboratory arrangement aboard the RV *George B. Kelez* showing C. Bartlett, electronics technician, operating PDP-8 computer which is a component of the STD computer-on-line data acquisition and processing system.

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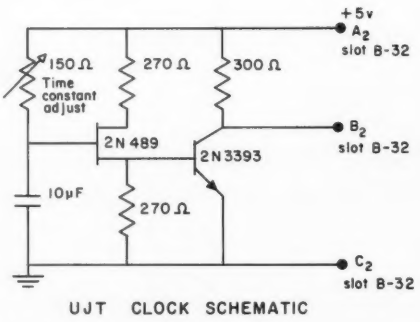
sen. Data manipulations following each print command are software controlled.

Digital Input Interface

A Digital Equipment Corporation Digital Input Subsystem type DS80 interfaces the digitizer and the computer. It allows software interrogation and control of digits produced by the counters. Twenty-seven parallel wires come from each counter; there are four lines for each of the six digits plus a print command, inhibit, and ground wire. A list of wire connections, between the 50 pins of the BCD connector plug on the back of the counter and the DS80 input slot-A, and rewiring of the DS80 slot-A pins to slot-B pins are shown in Table 1. In the DS80, 72 of the 96 possible contact inputs are used. These are divided into six, 12 bit data words; words 1 and 0 are temperature, words 3 and 2 are salinity, and words 5 and 4 are depth. This completes the hardware data link to the computer. Four input/output transfer (IOT) instructions provide access of any data word to the accumulator of the computer by software control.

Computer, Software, and Output

The computer system is a Digital Equipment Corporation 12 bit PDP-8 with 4K of core memory and two peripheral units, a TU 55 dual transport DECtape, and an ASR 35 Teletype which provides data storage and output on magnetic tape, punched paper tape, and paper printout. The essential features of the software program which was written in assembly language are the following. Prior to lowering the STD unit, the maximum depth, a depth printout (i.e., 2, 5, or 10 m, etc.), and a depth sampling window around the desired depth are selected (i.e., ±1, 2, or 5 m, etc.). Every 300 msec during lowering the print command from the temperature counter interrupts the computer. The program then reads the six data words and stores them in salinity temperature, and depth buffers of the core memory provided the current sample is within one of the preselected depth windows. Lowering speed is manually controlled to provide a minimum of 7 and a maximum of 127 values in each buffer. When the sensors get below the depth window, preliminary processing is performed on these data; for greater effectiveness in obtaining real time data, corrections due to calibration and gradient errors are added automatically. Conversions are made from BCD to octal numbers, then from time units to engineering units. Values are smoothed by a 3 point smoothing routine, salinity values are corrected for errors due to slow temperature compensation in thermal gradients, zero offset corrections determined for each sensor by field calibrations are added, and the final corrected values nearest the desired depth are stored in another buffer. The initial buffer is reused for the samples in the next depth window, and temperature and salinity values at the desired depth interval are output on the teletype from the final buffer when the cast depth is reached. Following the typing the same data are stored on the DECtape. The final products of this initial computer program are therefore data in the form of an analog trace and digitized values at selected meter intervals stored on magnetic tape, punched paper tape, and paper printout.



UJT CLOCK SCHEMATIC

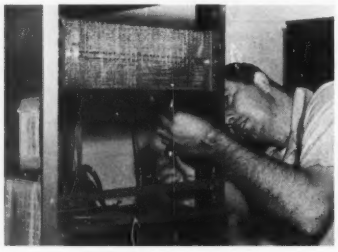


Figure 3.—Diagram (top) of Unijunction Transistor Clock (UJT) designed by C.J. Bartlett who is shown (bottom) adjusting the time constant which is variable between 75 and 750 msec. Clock is used for an external electronic control to initiate period counts on three counters simultaneously.

TEST RESULTS

From 15 October to 2 November 1971, 23 test lowerings were made and routine data were obtained at 32 stations off the coasts of Washington and British Columbia with the new system. The sensors were lowered at a speed of 30 m/min from the surface to a depth of 300 m; speed was increased to 60 m/min from 300 to 1500 m. Of primary interest is the agreement between the computerized data and data obtained from standard reversing water bottles.

Sensors were calibrated by lowering them to a depth where the graphic trace indicated temperature and salinity values were uniform over several meters. Then a multibottle sampler attached to the wire within 3m of the sensors was electronically actuated to obtain a water sample and readings off two reversing thermometers from the layer. This procedure was repeated at several different

Table 1.—Wiring list for counter to DS80 input cables and internal pin to pin wiring added to DS80.

Wiring for BCD plug on counters			DS80 internal wiring					
			Temperature		Salinity		Depth	
Counter digit	BCD weight	BCD output Pin No.	Input $Slot_1$-Pin_1	$Slot_2$-Pin_2	Input $Slot_1$-Pin_1	$Slot_2$-Pin_2	Input $Slot_1$-Pin_1	$Slot_2$-Pin_2
10^5	8	37	A32 - A2	B32 - E2	A30 - A2	B26 - E2	A28 - A2	B20 - E2
	4	36	A32 - B2	B32 - J2	A30 - B2	B26 - J2	A28 - B2	B20 - J2
	2	12	A32 - C2	B32 - N2	A30 - C2	B26 - N2	A28 - C2	B20 - N2
	1	11	A32 - D2	B32 - S2	A30 - D2	B26 - S2	A28 - D2	B20 - S2
10^4	8	35	A32 - E2	B31 - E2	A30 - E2	B25 - E2	A28 - E2	B19 - E2
	4	34	A32 - F2	B31 - J2	A30 - F2	B25 - J2	A28 - F2	B19 - J2
	2	10	A32 - H2	B31 - N2	A30 - H2	B25 - N2	A28 - H2	B19 - N2
	1	9	A32 - J2	B31 - S2	A30 - J2	B25 - S2	A28 - J2	B19 - S2
10^3	8	33	A32 - K2	B30 - E2	A30 - K2	B24 - E2	A28 - K2	B18 - E2
	4	32	A32 - L2	B30 - J2	A30 - L2	B24 - J2	A28 - L2	B18 - J2
	2	8	A32 - M2	B30 - N2	A30 - M2	B24 - N2	A28 - M2	B18 - N2
	1	7	A32 - N2	B30 - S2	A30 - N2	B24 - S2	A28 - N2	B18 - S2
10^2	8	31	A32 - P2	B29 - E2	A30 - P2	B23 - E2	A28 - P2	B17 - E2
	4	30	A32 - R2	B29 - J2	A30 - R2	B23 - J2	A28 - R2	B17 - J2
	2	6	A32 - S2	B29 - N2	A30 - S2	B23 - N2	A28 - S2	B17 - N2
	1	5	A32 - T2	B29 - S2	A30 - T2	B23 - S2	A28 - T2	B17 - S2
Print Command		48	A32 - U2	B32 - U2				
Inhibit		22	A32 - V2	B32 - B2	A30 - V2	B32 - B2	A28 - V2	B32 - B2
10^1	8	29	A31 - A2	B28 - E2	A29 - A2	B22 - E2	A27 - A2	B16 - E2
	4	28	A31 - B2	B28 - J2	A29 - B2	B22 - J2	A27 - B2	B16 - J2
	2	4	A31 - C2	B28 - N2	A29 - C2	B22 - N2	A27 - C2	B16 - N2
	1	3	A31 - D2	B28 - S2	A29 - D2	B22 - S2	A27 - D2	B16 - S2
10^0	8	27	A31 - E2	B27 - E2	A29 - E2	B21 - E2	A27 - E2	B15 - E2
	4	26	A31 - F2	B27 - J2	A29 - F2	B21 - J2	A27 - F2	B15 - J2
	2	2	A31 - H2	B27 - N2	A29 - H2	B21 - N2	A27 - H2	B15 - N2
	1	1	A31 - J2	B27 - S2	A29 - J2	B21 - S2	A27 - J2	B15 - S2
Ground		50	A31 - K2	B31 - C2	A29 - K2	B29 - C2	A27 - K2	B27 - C2

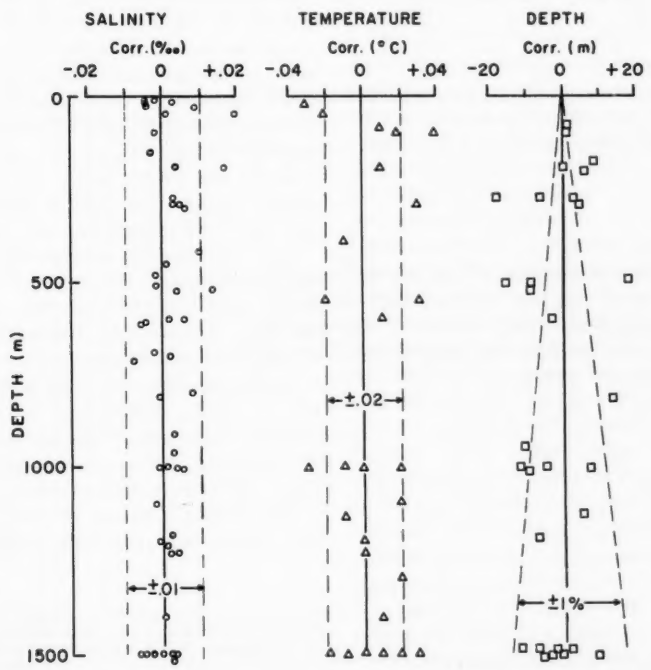


Figure 4.—Comparison of STD-computer produced data with simultaneous data from Nansen bottles. The plots of computer corrections vs depth show that the precision of the data from the shipboard system compares favorably within a factor of 2 to 3 around the standard accuracy ranges expected from Nansen bottle data.

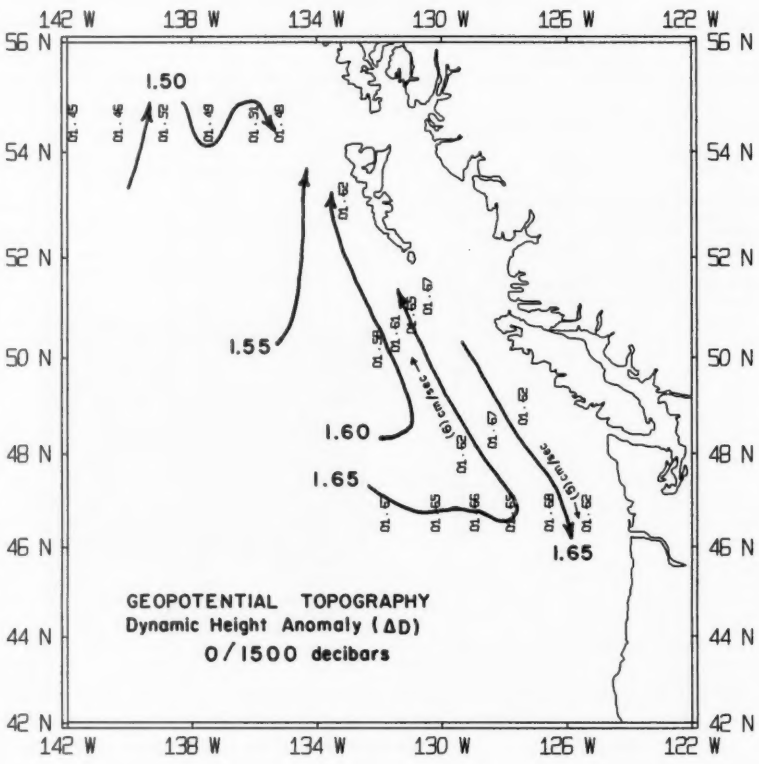


Figure 5.—Surface geostrophic currents computed from salinity, temperature, and depth data collected during October test cruise. This illustration shows one way of presenting the environmental information for analysis for later comparison with fisheries data.

depths when weather conditions were good, and at least one calibration point was obtained at each station throughout the cruise to detect any shift in calibration with depth or any change with time. Water samples were analyzed aboard for salinity by precision laboratory salinometers, and thermometers were corrected by standard techniques. Comparison of computed data with data from water bottles and reversing thermometers at the calibration points indicated a close agreement of temperature values within about ±0.02°C, of salinity values within about ±0.01 ‰, and of depth values within about ±1% (Figure 4). This is quite an acceptable error especially considering that this method of comparison assumes no error in the data from reversing water bottles which may normally be expected to vary at best ±.01°C, ±.003 ‰ , and ±.5%.

In view of the success of this system which provides rapid, accurate STD data, other sensors such as dissolved oxygen will also be interfaced to the computer. Later in the total MARMAP operational mode, various devices which measure chemical nutrients, water fluorescence, light intensity, surface salinity, and surface temperature simultaneously while the vessel is underway will provide marine scientists with a rather complete picture of environmental conditions.

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MFR PAPER 989

Tips on gaining a larger share of the military market for seafood products.

Procedure for Product Approval and Purchase: Army and Air Force Exchange Service[1]

HENRY I. BOIES and RICHARD C. RAULERSON

The Army and Air Force Exchange Service (AAFES) procures food products for use by military installations worldwide, including post exchange (PX) and base exchange (BX) food outlets, but excluding troop feeding, clubs, and commissaries. AAFES is a large buyer. In 1972 it handled food products valued over $176 million, including seafood valued over $1.4 million. Examples of frozen seafood products currently approved for purchase include: catfish (whole and fillets), clam fingers, cod (fillets, sticks, and cakes), crab cakes, batter-dipped fish (unspecified), flounder portions, haddock portions, halibut (steaks and fillets), scallops, shrimp (breaded, P & D, and tempura), breaded oysters, perch fillets, seabass fillets, seacake (unspecified) and comminuted croaker portions.

Although AAFES represents a fairly large outlet for a diverse number of seafood products at present, it is felt that this market outlet has not been fully developed either in terms of volume or number of products. And a major reason for this is that most potential suppliers lack adequate knowledge of this market. Actually, AAFES is quite flexible in its manner of procurement of supplies and will accept samples and product information from any manufacturer (prime source) or regular dealer. AAFES is desirous of providing on-base military personnel with fine quality products at the best price possible. During each year it observes and samples hundreds of different food items in order to keep current with the ever changing trends in food.

[1]This explanation of procedures for product approval and purchase is based on information supplied by the Army and Air Force Exchange Service personnel in Dallas, Texas.

Henry I. Boies and Richard C. Raulerson are members of the staff of the Market Research and Services Division, NMFS Southeast Region, St. Petersburg, FL 33701.

INTRODUCING A PRODUCT

The general procedure in selling to AAFES is to arrange first for an appointment with one of the procurement specialists at AAFES headquarters or at one of five exchange regions, preferably one located nearest to the point of distribution (refer to map and list of corresponding list of addresses). The procurement specialist contacted generally calls in one or more food specialists to determine whether or not there is any interest in the product. Samples should be made available with as much written information as possible. Any additional oral information during the meeting with the group or individual is always helpful. Some selling points of the product by the vendor add strength to the transaction. If the procurement specialist feels there is a possibility of using the product, it is then tested and sampled in AAFES facilities by food specialists and it is then determined if it will be accepted or rejected.

This procedure takes a minimum of ten days to two weeks. The individual or firm that presented the product is notified, usually by telephone, as to the result, although it is permissible for the vendor to contact AAFES at an earlier date if he wishes.

PRODUCT ACCEPTABILITY AND PURCHASE

If the product is found acceptable, temporary procurement authority is given and it will be included in the AAFES Food and Expense Supplies Purchase Descriptions, ESM 65-3. This manual is revised and distributed to the various procurement officers, as needed. Even though the product has been accepted and placed in the manual, this does not mean that the procurement officer will buy and use the product. A follow-up by the vendor at the various purchasing centers in the area where he might be interested in selling is one of the best ways of getting the product used. Supplying the individual procurement officer with sufficient samples and information is helpful in gettting the product used in that particular region or area.

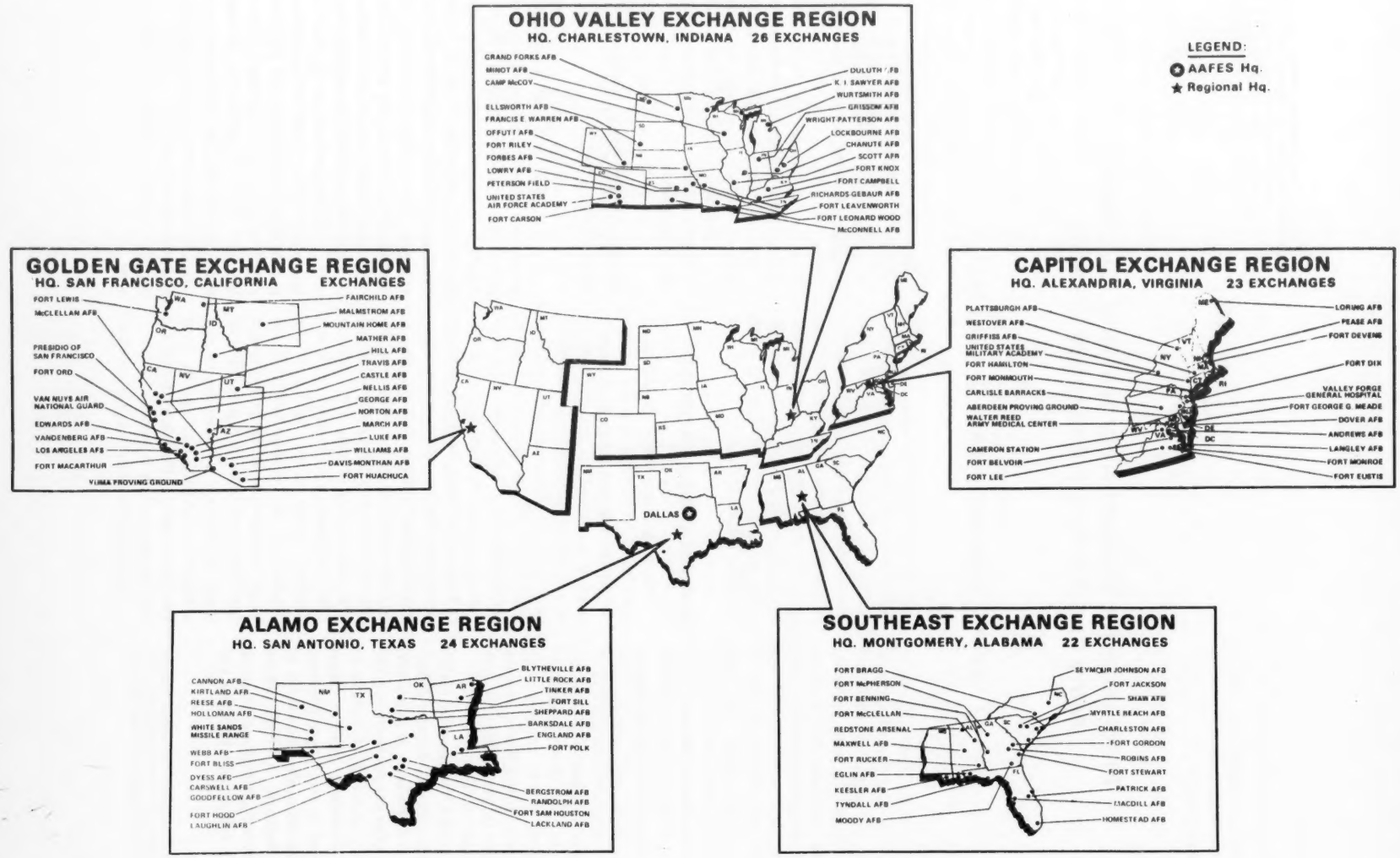

Figure 1.—Regions of the Army and Air Force Exchange Service and installations served.

All purchases for overseas exchanges are made by procurement personnel at AAFES Headquarters in Dallas. Purchases for exchange feeding facilities in the United States (excluding Hawaii and Alaska) are made in the five regional purchasing centers by procurement personnel.

PRODUCT SPECIFICATIONS

Before actual purchase, all products must meet specifications. Although not necessary, it is helpful if the plant where the product is processed operates under some type of inspection service. Otherwise, processing plants or distributors are inspected on a periodic basis by government representatives. There is no charge for this service, which covers sanitation, type of equipment used, general appearance of plant and grounds, location, appearance of employees, and other factors that would indicate the proper processing and distribution of the product.

In sum, the Army and Air Force Exchange Service represents a potentially large market which has not been fully developed by our domestic seafood industry. It is hoped the information contained in this report will assist industry in pursuing this opportunity.

Addresses and telephone numbers of AAFES headquarters and regions (Figure 1) are:

Headquarters

Mr. Edward E. Ausel
Buyer Consumables
Headquarters, AAFES
3911 South Walton Walker Boulevard
Dallas, Texas 75222
Tel: 214-330-3644

Mr. Lawrence M. Lefkof
Overseas Buyer
Headquarters, AAFES
3911 South Walton Walker Boulevard
Dallas, Texas 75222
Tel: 214-330-3836

Regions

Ohio Valley Exchange Region, AAFES
Attention: Seafood Buyer
Building 2501
Indiana Army Ammunition Plant
Charleston, Indiana 47111
Tel: 812-283-1502

Capitol Exchange Region, AAFES
Attention: Seafood Buyer
Building 6
Cameron Station, Virginia 22314
Tel: 703-751-2000

Southeast Exchange Region, AAFES
Attention: Seafood Buyer
Montgomery Industrial Terminal
Building T-5
1280 Kershaw Street
Montgomery, Alabama 36108
Tel: 205-264-7301

Alamo Exchange Region, AAFES
Attention: Seafood Buyer
Building 370
Fort Sam Houston, Texas 78234
Tel: 512-225-5381

Golden Gate Exchange Region, AAFES
Attention: Seafood Buyer
Box 3553
San Francisco, Calif. 94119
Tel: 415-556-3400

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MFR PAPER 990

A new device offers fishermen and scientists a means for tracking king crabs under water.

Sonic Tags Attached to Alaska King Crab

GERALD E. MONAN and DONALD L. THORNE

Gerald E. Monan and Donald L. Thorne are members of the staff of the NMFS Northwest Fisheries Center, Seattle, WA 98112.

ABSTRACT

A system for monitoring the location and movement of free-moving Alaska king crab in their natural environment is described. The sonic tag and related ultrasonic tracking equipment were used on crab in the Bering Sea near Unalaska, Alaska. Feasibility tests indicated the system appears to be a feasible tool for aiding in the harvest and management of king crab.

INTRODUCTION

In the last few years, there has been considerable interest in biotelemetry among fishery biologists. Biotelemetry has manifested itself in a variety of ways including "tracking" of various sea creatures from fish to lobsters, primarily to learn more about their behavior and physiology (Clifton, et al., 1970; Johnson, 1960; Moll and Legler, 1971; Trefethen, 1956; and Yuen, 1970). Recently, however, sport and commercial fishermen have become increasingly interested in direct adaptation of these research tools to increase the efficiency of harvesting techniques (Monan, 1971; Laurs, Johnson, and Yuen[1]).

The objective of our study was to explore the feasibility of utilizing sonic tags to aid in the harvest and management of the Alaska king crab. Tests were performed in Unalaska, Alaska, and aboard the MV *Dauntless* in the Bering Sea near Unalaska in September 1972. The sonic tags were fabricated by the Northwest Fisheries Center (NWFC), National Marine Fisheries Service (NMFS), in Seattle, Washington, and taken with the related tracking gear to the Unalaska area for testing.

SONIC TAG AND RELATED EQUIPMENT

Three main components make up a sonic tracking system: the sonic tag or pinger, the hydrophone, and the receiver. The tag is attached to or placed inside the animal to be tracked and transmits a signal through the water. This signal is picked up by the directional hydrophone and fed into a receiver, where it is amplified and converted to an audible tone. The hydrophone is rotated in the water until the maximum signal is heard; the direction of the hydrophone then indicates the direction of the tagged animal from the operator.

The sonic tags and hydrophone used in this study were designed and built by personnel of the Division of Coastal Zone and Estuarine Studies, NWFC, NMFS. A commercial receiver was used.

Sonic Tag

Tags for the king crab are made up in two parts fastened together to make a single unit (Figure 1). The electronic portion of the tag lies atop a molded base used to attach the tag to the crab. A schematic diagram of the electronics is shown in Figure 2, the parts list given in Table 1. The batteries and electronics, except coil T-2 and the reed switch, are placed inside the hollow hemispherical crystal. The coil and the reed switch are located just outside the crystal. The crystal is then filled with epoxy resin (Furane plastics Epocast 202[2]), which is allowed to harden. The coil and the reed switch are covered with epoxy when the electronic portion of the tag is united with the base.

The base portion of the tag is made to conform to part of the carapace of the king crab. Plaster of Paris is used to make an impression of the area surrounding the concavity between the right and left branchial regions of the carapace. A mold is subsequently made from this impression.

To assemble the tag, two lengths of nylon covered steel wire are placed in the mold so the ends protrude, two on each side of the midline on the forward edge of the tag and two on each side of the midline on the rear edge of the tag. The pre-potted electronic portion of the tag is set into the mold, flat side down, and the mold filled with epoxy to approximately ⅜-inch on the side of the crystal. Epoxy is also brushed over the crystal until it is completely covered by a thin layer.

The completed tag, including the

[1] Laurs, Michael, James M. Johnson, and Heeny S. H. Yuen. Manuscript in preparation. Short term movements of albacore off central California as determined by ultra-sonic tracking. National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, California.

[2] Use of trade names in this publication does not imply endorsement of commercial products by the National Marine Fisheries Service.

base, is 2½ inches in diameter and 1½ inches high. Its weight is 4.9 ounces (140 g) in air and 2.9 ounces (85 g) in water. It operates at a frequency of 45 kHz with a pulse rate of 2 pulses per second. Duty cycle is 2% and tag life, approximately 5 days. Acoustic output measured on the center line of the crystal is 68 db, reference 1 μ bar at 1 yard. A magnet placed on the outside of the tag over the reed switch keeps the tag inactive until the magnet is removed just before tagging.

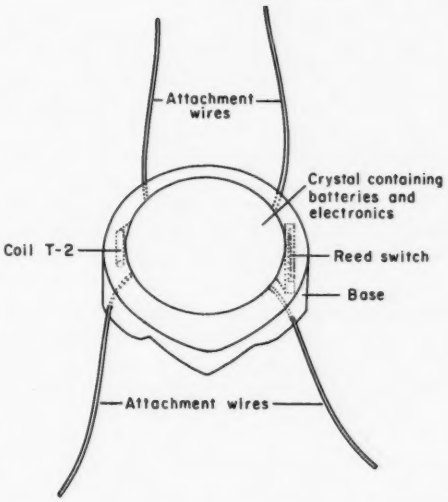

Figure 1.—A sonic tag for attaching to king crab.

Hydrophone

The hydrophone consists of a 90° conical, cork-lined, stainless steel reflector (7 inches maximum diameter), with two 50 kHz piezoelectric ceramic cylinders (Edo Western PN 17097) mounted on the axis of the cone. The sensitivity of the unit is −82 db reference 1 volt/μ bar at 1 yard. The beam pattern, conical and rather sharp, is −3 db at 12° and −20 db at 30°. During our tests the hydrophone was mounted on the side of the *Dauntless* at the end of a long steel pipe which extended vertically beyond the keel level. The pipe was fastened to the hull in a mounting that allowed the operator to rotate the hydrophone 360°. It was also possible to control the tilt of the hydrophone from an attitude approximately parallel with the water surface to a point where the hydrophone was pointed straight at the bottom of the sea.

Receiver

The sonic receiver used during these tests was a Lawson VLF-1 with a tuning range of 20 to 80 kHz and a sensitivity of 1 μ volt at 10 db signal to noise ratio.[3] The receiver operates on the superhetrodyne principle with mechanical bandpass filters to provide extremely sharp selectivity characteristics. A tunable beat frequency oscillator provides an audio tone for continuous wave signals. The unit operates on batteries or a.c., has an output of 1 watt, and a self-contained speaker and phone jack.

[3] This receiver has been discontinued by the manufacturer, but similar sonic receivers are available.

FEASIBILITY TESTS CONDUCTED

Field testing was done aboard the crab boat MV *Dauntless,* fishing for king crab north of Unalaska Island. The main objectives of our tests were to: (1) develop a technique for attaching the tag to the crab; (2) examine the crab's ability to carry the tag and to observe its reactions, if any, to the tag; and (3) determine if the output of the tag provides adequate tracking range.

Additional testing on tag effects was performed with crab held in a live tank (10-ft wide, 12-ft long, and 7-ft deep) at Unalaska.

Attachment

Tags were placed on the backs of a number of various-sized king crab available in the catch of the *Dauntless* to determine if the shape of the tag base was compatible with the general curvature of the carapace. The tag fit very well on the range of crab sizes tested (approximately 6.25 to 8.0 lb). Actual fastening of the tag was accomplished by attaching the wires extending from the base of the tag to the crab's carapace. Four small holes were pierced in the carapace, two along the anterior edge and two along the posterior edge. The two wires extending from the leading edge of the tag were placed forward at about 45° to the right and left of the midline of the tag, and each was pushed through a hole in the anterior edge of the carapace. The wires were then brought over the top of the carapace and fastened at the midline with a crimped metal sleeve. The tag was held in position on the crab's back while the wires from the rear of the tag were passed, in a similar manner, through the holes in the posterior edge of the carapace. When these wires were pulled tight and fastened with a metal sleeve, the tag fit snugly into the depression on the back of the crab (Figure 3). After the wires were secured, the loose ends were trimmed. The attachment took less than 2 minutes.

Effect of Tag

Positive determination of the effect of the tag on the crab requires long-term observations which time did not permit. However, observations over several hours were made of tagged crab held in the live well on the boat. The tag was repeatedly activated and deactivated in the presence of a number

of untagged crabs, during which time we watched for any apparent reactions to the ultrasonic transmissions. Non- were noted. A tagged crab was also observed briefly in shallow water off the beach where it moved about with no apparent concern about the tag on its back.

Tests in the live tank at Unalaska indicated that approximately 30 minutes were needed for crabs to recover from handling and sonic tagging procedures. When released in the tank immediately after tagging, tagged crabs settled to the bottom of the tank, usually upside down, and remained quiet for approximately 30 minutes. They then righted themselves, and their subsequent behavior was similar to that of untagged crabs in the tank. Untagged and tagged crabs that had recovered from the tagging process landed on the bottom of the tank in an upright position even when released upside down. These same crabs, if placed on the bottom upside down, quickly righted themselves.

Observations of crabs in the tank were made with the sonic tag activated and not activated. No apparent reactions to the tag were noted among either tagged or untagged crabs.

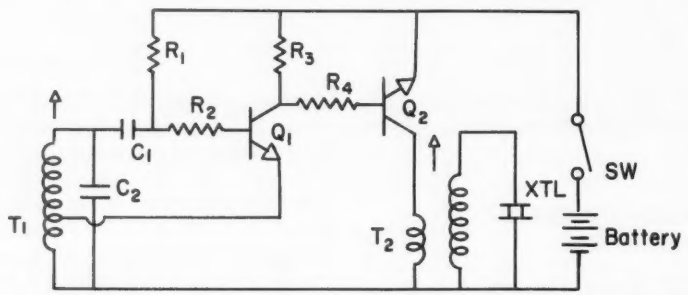

Figure 2.—Schematic diagram for the king crab tag (45 kHz, pulse rate 2 pps, duty cycle 2%). (See Table 1 for parts list.)

Table 1.—Parts lists for the king crab tag. (See Figure 2 for schematic diagram.)

T_1	= 350 turns of # 40 wire[1]
T_2	= Primary—30 turns # 32 wire[1] Secondary—325 turns # 34 wire
C_1	= 0.68 MFD
C_2	= 0.0082 MFD
R_1	= 2.4 M
R_2	= 1.5 K
R_3	= 3.3 K
R_4	= 1 K
Q_1	= 2N2925
Q_2	= 2N3702
XTL	= Edo Western part number ADO 316-1 (hemisphere 1.75 inch OD with 0.125 inch wall).
Battery	= 12 volt, 190 MAH (8 silver oxide cells-Eveready type S76E or equivalent).
SW	= Magnetic reed switch.

[1] Coils are wound on 0.1875 inch diameter coil forms and tuned with ferrite slugs.

Effects of the tag on long-term survival of the crab were undetermined in these tests. Based upon limited observations, we can say that once the crab recovered from tagging, the tag did not appear to affect the crab's behavior or immediate well being. Previous observations at Unalaska had shown that harvested crabs will survive in the live tank for approximately 6 days; our tagged crab survived approximately 6½ days.

Tracking Range

Crabs with sonic tags attached were lowered in a small shrimp pot approximately 57 fathoms to the bottom in the sheltered waters of Akutan Bay northwest of Unalaska and on the fishing grounds in the open sea. With the hydrophone in position over the side of the ship, we motored away from the tagged crabs. Periodically, we stopped the boat to listen. In both the inshore and offshore tests, we obtained strong, usable signals with good directional quality up to 0.8 nautical mile. Beyond this distance, audibility of the tag signal dropped off rapidly.

A similar test was made with a tagged crab placed in a conventional crab pot with the tunnels closed, which was dropped to 117 fathoms. Usable range in this instance was about 0.4 nautical mile. Unfortunately, the results of this test were somewhat inconclusive as the crab was not inside when the pot was brought back aboard the ship. It was theorized that the velocity of the water passing through the pot as it sunk to the bottom had broken up the crab and forced it through the web. Because of weight-balance characteristics of the tag, there was reason to believe the crab was upside down on the bottom. Unfortunately, we had no more tags with which to repeat the deep-water tests.

CONCLUSIONS AND RECOMMENDATIONS

The sonic tag and tracking system appears to be a feasible tool for aiding in the harvest and management of king crabs. We consider the design of the tag and the method of attachment to be satisfactory. Improvement undoubtedly can be made in the tracking system.

Although tracking range was adequate, it can be substantially increased with more sensitive receiving equipment. Hydrophones with variable beam patterns would be helpful—a wide pattern for use in searching for tagged crabs and a narrow beam for tracking. In our tests the hydrophone was manipulated by hand from the deck of the ship. The operation would be more practical if the hydrophone were manipulated remotely from the ship's wheelhouse so that the receiver would be protected from the elements and the operator would be in close proximity to the steering controls of the ship. Instead of mounting the hydrophone on the side of the vessel, a through-hull unit could be installed in a location

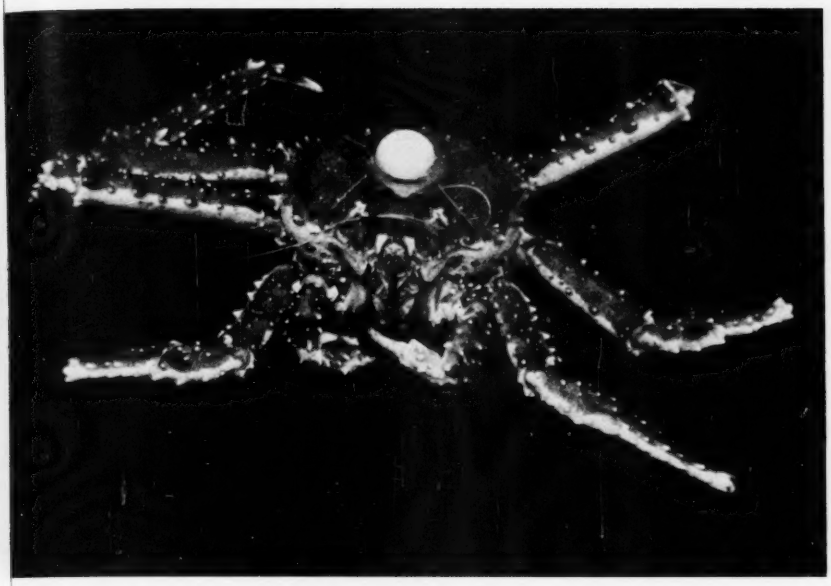

Figure 3.—Male king crab with sonic tag attached.

with a minimum of acoustic interference. As used in the recent test, the cone-shaped hydrophone set up an excessive turbulence when the ship was under way and severely limited its effectiveness. This problem can be greatly reduced by placing the hydrophone inside a faired housing.

A number of applications of the system are readily foreseeable, provided that the presence of the tag does not significantly alter the normal behavior of the crab (additional tests are needed for positive determination). Crabs that are caught, tagged, and released on the fishing grounds could be used by fishermen to monitor their movements and, presumably, the presence of other crabs. This would assist fishermen in keeping their pots set in productive areas and materially reduce the amount of unproductive time spent searching for crab concentrations. Research and management agencies also could use sonic tracking to develop information on crab behavior and short-term migration patterns. As interest develops and more individuals become familiar with the technique of electronically tracking free-moving crabs in their natural environment, additional studies will almost certainly suggest themselves.

ACKNOWLEDGMENTS

In addition to the authors, members of the research team responsible for the development of the sonic tag and related tracking techniques for king crab were Gordon F. Esterberg, Kenneth L. Liscom, James H. Johnson, and Charles D. Volz. We are grateful to Arnie Madsen, owner and skipper of the MV *Dauntless*. Special thanks are also due to Mark Buckley, Peter Jackson, and Robert Tamburelli of the Alaska Department of Fish and Game for their cooperation and assistance in making these tests.

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MFR PAPER 991

Devaluation can mean more dollars for the U.S. fisherman, opening up expanded world markets.

Export Opportunities for U.S. Fishery Products

MORTON M. MILLER, JUKKA KOLHONEN, and GREGORY HALL

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INTRODUCTION

Strong and growing world demand for fishery products and the recent favorable realignment of international currencies, from a U.S. viewpoint, combine to create attractive export opportunities for U.S. fishery products. This means expected growth for the traditional items on our export list and, too, an expanded opportunity for the exporting of fishery products derived from underutilized species, that is, species not traded in the U.S. domestic markets to a large degree.

The export possibilities for U.S. seafood products have been expanding considerably. Economic growth and rising incomes worldwide have sparked a growing demand for seafood products, particularly in the industrialized nations. Traditional sources of supply have been hard put to keep pace with the rising demand and buyers are actively searching world markets for new sources. International currency realignments, over the past 14 months, have lowered U.S. prices abroad and have made U.S. products more attractive to many foreign buyers. Table 1 indicates the change in the values of currencies, relative to the dollar, for major nations that have trade with the U.S. in fishery products.

Table 1.—Percentage changes in value of key foreign currencies in relation to United States dollar.

Country	*4/1/71 to 12/31/71*	*3/1/71 to 2/28/73*
Japan	+ 16.9	+ 36.8
West Germany	+ 13.6	+ 26.2
France	+ 8.6	+ 20.6
Denmark	+ 7.5	+ 19.4
Norway	+ 7.5	+ 19.4
Sweden	+ 7.5	+ 13.5
Italy	+ 7.5	+ 11.2
United Kingdom	+ 8.6	+ 3.8
Canada	+ 0.8	+ 1.4
Iceland	0.0	0.0
Mexico	0.0	0.0

Source: International Trade Analysis Staff, Bureau of International Commerce, as of April 17, 1973.

JAPAN'S IMPORTS OF FISHERY PRODUCTS INCREASING

Increasing demand for fishery products has been especially strong in Japan. The average Japanese urban household spends about $1.60 for fishery products for each $1.00 spent for beef, pork, and chicken combined. During 1965-1970 expenditures for fishery products per urban household in Japan rose from $95 to $148. The gain reflected higher prices more than a greater quantity consumed, but is nevertheless a clear indicator of increasing demand strength. Japan has been importing increasing quantities of fishery products from a dozen major sources, including the United States. In 1970, Japan's fishery products imports were valued at $318 million, of which $24 million was from the U.S. In the 1960-1970 period, imports of fishery products into Japan increased at an average yearly rate in excess of 35 percent.

HEAVIER DEMAND AND IMPORTS IN EUROPE

Throughout Europe demand for seafoods has been rising. It has been particularly strong in the Mediterranean countries. In Italy, for example, consumption of frozen fish rose 18 percent over the 3-year period, 1969 to 1971. During the 1960's consumption of fishery products in Spain doubled and it increased more than 50 percent in Greece during the same period. It is notable that increases in seafood imports have supported gains in consumption in many of the European nations, as can be seen from Table 2.

Table 2.—Imports of fresh and frozen fish (1,000 metric tons).

Country	*1960*	*1969*	*1970*
France	33.2	86.2	n.a.
Italy	66.1	100.8	n.a.
Spain	1.5	n.a.	32.7

SLOWER GROWTH IN WORLD CATCHES

Concurrent with the growing world demand, catches of fish for human consumption have tapered off. In the 1950's world catches increased by 5.6 percent per year. In the 1960's the rate of increase dropped to 3.1 percent per year.

OPPORTUNITIES TO EXPAND ESTABLISHED MARKETS

The U.S. exported $158 million in fishery products during 1972. Shrimp, salmon, and fish oils were the three major categories, accounting for slightly more than two-thirds of this total. However, the remaining third of our exports included many fresh and frozen, dried, salted, and canned products.

Table 3.—Selected United States exports.

Fish products	1966		1972		% Change	
	(1,000 lb.)	(1,000 dol.)	(1,000 lb.)	(1,000 dol.)	Volume	Value
Salmon						
Fresh/frozen	19,845	10,625	34,685	28,451	+ 74.8	+ 167.8
Canned	20,484	14,561	21,358	20,899	+ 4.3	+ 43.5
Shrimp (all)	9,406	10,238	37,434	41,126	+ 297.9	+ 301.7
Fish oil	77,255	7,401	193,198	15,275	+ 150.1	+ 106.4

U.S. exports of fishery products have increased considerably in the past decade. The trend shows that between 1962 and 1972, poundage of edible fishery products exports increased about 11 percent per year, while the annual trend increase for imports was 6 percent. Value wise, the trends in U.S. fishery products exports and imports, increased respectively at annual rates of 13 percent and 11 percent. The performance of major items since the mid-1960's is shown in Table 3.

Fresh and Frozen Salmon

A strong market for frozen salmon exists in Europe, and U.S. exporters have been aiming at it. The United Kingdom and other common market countries receive about 56 percent of the U.S. shipments of frozen salmon. Formerly, the U.K. alone accounted for nearly half the amount exported to Europe but in recent years the market has widened (Table 4).

Table 4.—United States exports: fresh/frozen salmon (thousand pounds).

Exports to	1966	1972
United Kingdom	5,163	6,232
% of total	26%	18%
European Economic Community[1]	5,611	13,042
% of total	28%	38%
All other countries	9,071	15,411
% of total	45.7%	44.4%
Total	19,845	34,685

[1]Exclusive of United Kingdom.

Realignment of currencies has given impetus to market expansion. Exports to France and Sweden especially jumped in 1972, an event attributable, at least in part, to the realignment in December, 1971. The value of Swedish krona increased 7.5 percent and French franc 8.6 percent in terms of U.S. dollars.

The February 1973 devaluation of the dollar appreciated the Swedish krona an additional 5.5 percent and the French franc 11.0 percent in terms of dollars, thus tending to make U.S. exports to these countries correspondingly cheaper.

It is interesting to note that France, in 1971, increased her total imports of all fresh and frozen fish by 32 percent—and that most of this increase was the result of shipments from countries outside the European Economic Community.

Canned Salmon

U.S. exports of canned salmon (Figure 1) in 1972 increased 17 percent over the previous year. Over half of our exports of canned salmon go to the United Kingdom, but there are other significant markets elsewhere (Table 5).

Exports of canned salmon to the U.K. increased significantly in 1972—to 15.8 million pounds, from 10.4 million in 1971. A link between this gain and the currency realignment of 1971 is highly probable. The value of the British pound sterling appreciated 8.6 percent in December 1970, in terms of the dollar. The February devaluation of the U.S. dollar could further encourage U.K. purchases of canned salmon from the U.S., although much of the incentive will be washed out by higher import duties in the U.K. following U.K.'s entry into the common market. There is a plus side, however, Canada will no longer receive preferential treatment from the U.K., thus eliminating that country's former competitive advantage over the U.S. in trade with U.K. Also, the Japanese will likely take a smaller share of the United Kingdom market as a result of the recent appreciation of the yen in relation to the dollar (over 13 percent).

Table 5.—United States canned salmon exports (thousand pounds).

Exports to	1971	1972
United Kingdom	10,364.0	15,831.7
Canada	3,496.3	1,927.3
Netherlands	1,964.1	1,387.3
Australia	575.0	666.4
Japan	209.7	511.8
France	147.1	118.1
Denmark	29.4	5.3
Other	1,446.4	910.0
Total	18,232.4	21,358.1

Figure 1.—Canned salmon accounted for about one-seventh of the U.S. fishery products exports (by value) in 1972. Over half went to the United Kingdom, but other markets in Europe and Asia are opening up. Above, cans are being packed with salmon preparatory to cooking.

Figure 2.—Shrimp ranks second to salmon in U.S. fishery exports. There is a growing market abroad for the northern shrimp, such as those taken in New England, shown here.

Shrimp

Shrimp ranked second to salmon in importance as a U.S. fishery export. Shipments in 1972 amounted to 29 million pounds, valued at $32 million. Exports declined slightly in 1972 from the previous year, as greater quantities were absorbed in a growingly attractive domestic market. There are bright prospects, however, for further development of export markets for northern and Alaskan shrimp (Figures 2 and 3). These varieties closely resemble their European-originated counterparts, and are highly acceptable in European markets. At the same time, they are generally less preferred than the larger southern shrimp in U.S. markets.

Six countries accounted for nearly all the U.S. shrimp exports in 1972.

Trade between the United States and the two major foreign purchasers of U.S. shrimp, Canada and Mexico, has

Figure 3.—Pandalid shrimp such as those taken in New England and off Alaska meet a readier acceptance in foreign markets than do the big shrimp from the Gulf of Mexico preferred in the United States. These Alaskan fishermen are bringing their day's catch to the plant for processing.

Figure 4.—Exports of salmon roe to Japan declined about 28 percent in 1972, owing to an exceptionally low catch of salmon. Here salmon roe are being packed for shipment to Japan.

not been directly affected by currency realignment. Exchange rates between the Canadian dollar and the U.S. dollar have remained practically unchanged, as have the exchange rates between the U.S. dollar and the Mexican peso.

Table 6.—Countries accounting for nearly all of the United States shrimp exports in 1972.

Country	Shipments	
	(1,000 lb.)	(1,000 dol.)
Mexico	10,072	8,329
Canada	7,748	10,137
Sweden	4,096	4,062
Japan	2,625	4,284
United Kingdom	1,977	2,378
Denmark	1,126	1,281

Fish Roe

Japan imports sizeable quantities of fish roe. Formerly the bulk of Japan's imports of this item were from the U.S. In the wake of some U.S. supply problems, Japan has added roe supplies from North Korea and the USSR. U.S. exports of salmon roe (Figure 4) to Japan declined in 1972 to 3 million pounds from 4.2 million pounds in 1971. This was due mainly to an exceptionally low catch of salmon in the United States in 1972. Similarly, Japanese imports of Pacific herring roe (Figures 5 and 6) from the United States declined as a result of lighter U.S. production (Table 7).

Table 7.—Japanese imports of fish roe 1970-1972 (thousand pounds).

Country	1970	1971	1972
From United States	4,350.1	4,731.6	3,554.1
From other countries	3,120.0	3,937.0	11,605.6
Total	7,470.1	8,668.6	15,159.7

POTENTIAL FOR EXPORTING NEW PRODUCTS

Untapped and relatively abundant fishery resources provide a bright spot for expanded opportunities available to U.S. fishermen. These "underutilized" species consist largely of varieties of seafoods that have not attracted a large following among U.S. consumers—for example, squid, croaker, mullet, mussels, among others. This is not to say that these would be shunned by U.S. consumers, if concerted marketing efforts were launched. Probably most would be accepted. On the other hand, there are ready markets for many of these species overseas and, therefore, these species do represent a rather high export potential, one that recently has been made even more attractive by the favorable climate for U.S. goods produced by the dollar devaluation.

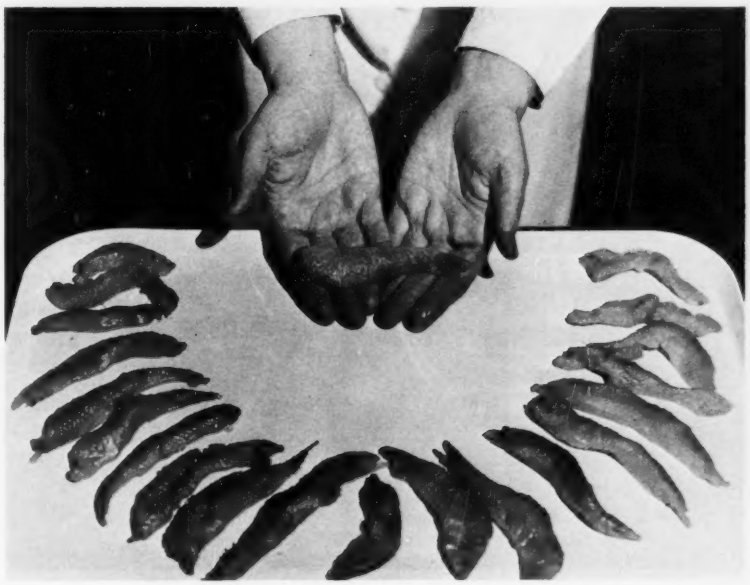

Figure 5.—Alaska's herring roe is a prized delicacy in Japan, bringing several dollars a pound.

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Examination of Japanese fish consumption data, for example, reveals that some of the major species are on the list of U.S. underutilized species (Table 8).

Table 8.—Average consumption per household in Japan, in value (yen) of fresh and frozen fishery products, 1970.

Fish products	*Household*	
	Urban	*Farm*
All fresh and frozen	27,485	23,289
Squid, cuttlefish	2,530	2,878
Jack mackerel	1,439	1,478
Sea bream	1,079	742
Saury	555	576
Cod, Alaska pollock	375	599

Squid, Fresh and Frozen

Squid are found in most areas of U.S. fishery activity, but a sizeable fishery exists only off southern California. The U.S. squid catch in 1970 amounted to about 27 million pounds (live weight), and over 90 percent of this total was landed in California. The potential catch, in California and other areas, is many times the present catch level. Squid has been classified as "much underutilized" among principal resources of the California fishermen (Ahlstrom, 1968). The State of California Department of Fish and Game also states that "the squid resource is underharvested," and that "the fishery is being conducted in only a small segment of this species range. Because these animals are short lived, there can be a more intensive harvesting of standing crop than in the case of long lived animals" (Frey, 1971).

The estimated potential of squid off the U.S. East Coast is above 200 million pounds, as compared with actual landings of only about 2 million pounds (Gulland, 1971).

The technology used in other food processing operations is adaptable to processing most types of squid. However, a potential drawback for production exists with one of the squid available to U.S. fishermen on the Atlantic coast (*Loligo pealii*). This variety has a "quill" which must be removed—presently through a manual operation.

There is only a limited market for squid in the U.S. as a food item. Principal consumers are among certain ethnic groups and gourmets. A substantial portion of the U.S. catch is sold as bait.

Abroad, there are potentially large markets for squid, particularly in Mediterranean countries. The U.S. now exports about 10 million pounds of squid annually, principally to Greece and the Philippines. The item is relatively inexpensive, worth about 13.4 cents per pound (f.a.s.). Total shipments were valued at $1.4 million in 1972.

At present, Japanese fishermen take squid off New England for sale in Italy, where it brings as much as 50 cents per pound for frozen squid at wholesale.[1] Greece is also a good potential market for U.S. squid. Imports of frozen squid in Greece went from 762 tons in 1967 to 1,206 tons in 1970. Greece also imports canned squid—2,680 tons in 1970. Devaluation should improve our trading position in this product.

Figure 6.—Japan is the sole buyer of U.S. herring roe. Exports declined in 1972, as a result of lighter U.S. production.

Atlantic Herring

Within the last 5 years U.S. exporters have built a modest trade in herring fillets in European markets, mainly West Germany. Herring products are in high demand throughout Europe. Herring landings in Gloucester, Massachusetts, have jumped to 40 million pounds to supply the export market. The export potential for herring fillets, however, has been only partially realized. Herring imported by West Ger-

[1]Japanese activity was centered on Georges Bank (about 150 miles offshore) in late 1972.

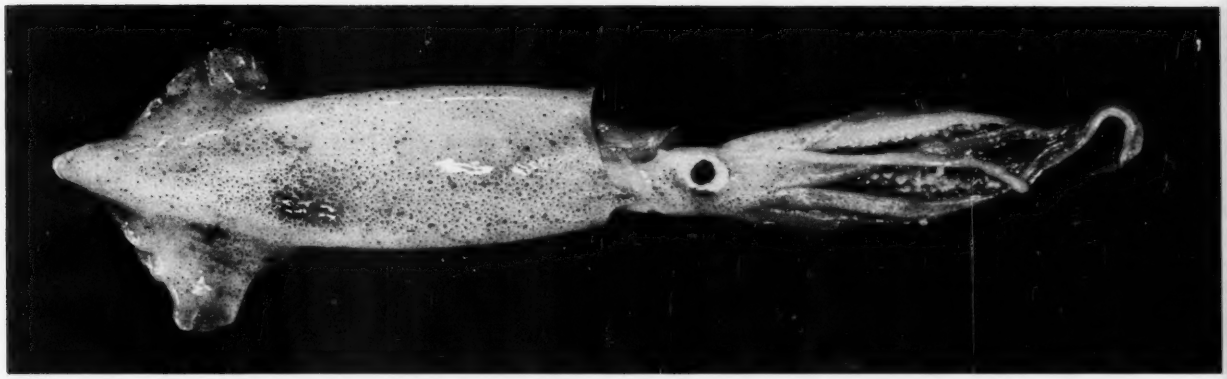

Figure 7.—Largely unappreciated in the U.S., squid is in substantial demand both in Europe and Asia. The only substantial U.S. fishery is in California. It is believed that the catch could be greatly increased. The estimated potential off the East Coast is more than 100 times present catches.

many and Belgium in 1971 from all sources is shown in Table 9.

There is heavy fishing for herring in the Northwest Atlantic, and stocks are probably fully exploited. A measure of control on stocks has been established by international agreement through a quota system which allots the United States about 25,000 metric tons (55 million pounds) for the Gulf of Maine and Georges Bank areas. It is in the U.S. interest to continue to pursue this quota.

Table 9.—Herring imported by West Germany and Belgium from all sources in 1971.

Country	*(1,000 lb.)*	*(1,000 dol.)*
Belgium	31,442	6,642
West Germany	287,977	50,734

In the European fisheries of the Northeast Atlantic, herring stocks have shown great fluctuations over the several centuries they have been fished. Apparently, exploitation rates on these stocks are presently heavy, which reduces the likelihood of increased catches from these areas to satisfy increasing demand on the Continent for herring products (Gulland, 1971).

Mullet and Other Roes

In recent months, the Japanese have been purchasing trial shipments of roe from suppliers in the U.S. Gulf area. Fish roe from a large number of species are a highly desired item in Japan. As a specialty product, they command high prices. Japanese consumption of roe is increasing steadily. Japan presently takes all herring roe produced in Alaska and the majority of salmon roe from Alaska and the Pacific Northwest.

Recently, whole Florida mullet has been sold to Japan. In Japan the mullet roe was to be removed and processed. Although the Japanese use exacting methods for the processing and preservation of fish roes, there is no reason to believe that our Gulf of Mexico industry could not implement these techniques. Export values could triple if the finished product was manufactured in the United States rather than selling the raw material to Japan and letting the value be added there.

A realistic figure for potential mullet roe sales in Japan, by U.S. suppliers would be in the order of about 100 tons per year. At current prices in Japan, this would be worth about $360,000 per year in U.S. sales. This would be a boon to the domestic mullet fishery, because it would represent considerable upgrading in the utilization of the mullet catch. About 1 million pounds of raw whole mullet would be converted into a product worth the equivalent of about 36 cents per raw, whole pound. Presently, mullet processed for the U.S. market has an average value of 17 cents per pound in terms of raw, whole fish.

There are some important technological considerations that must be taken into account in development work in the mullet fishery. Extraction of mullet roe, for example, requires a special knife and a certain amount of dexterity which is being adapted from existing Japanese production methods. Product specifications adhering to Japanese market requirements are being examined by an NMFS team from the Southeast Region.

The marketability of mullet flesh has been impeded by the occurrence of rancidity which develops during storage. Sea Grant in conjunction with the University of Florida is currently trying to develop a rancidity retardant.

Croaker Surimi

Surimi is ground or minced fish flesh from which the Japanese make a variety of specialty products such as fish sausages and fish pastes. Demand has been increasing sharply for surimi in Japan and this has put a strain on production. The texture of croaker flesh is preferred over all other species in surimi, but Japanese croaker production has reached a peak. In order to satisfy demand, the Japanese have turned to Alaska pollock as a source of surimi,

and to retain some of the croaker texture, surimi has been mixed in a ratio of 80 percent pollock and 20 percent croaker. However, this blending has not satisfied the delicate seafood taste of many Japanese consumers. The difference in demand is illustrated by the fact that pollock surimi sells for 25 cents per pound while croaker surimi goes for 48-50 cents per pound. The size of the Japanese market for surimi and similar products is huge. In 1970 the Japanese consumed over 2 billion pounds of processed "kneaded" products—which include fish sausage, etc. For this, consumers paid an average of 32 cents per pound—for an aggregate value of over $640 million.

Croakers are concentrated in the Gulf of Mexico, which provides about 90 percent of the U.S. catch of this species. United States croaker landings in 1971 were about 12 million pounds for human food, and 58 million pounds for industrial use—mostly pet foods. Moves are being made to divert more of this production into higher valued products for human consumption in domestic markets. For example, croaker has been used in the development of a fish-cake product; this has not quite hurdled all the technological barriers that stand in the way of marketing success, however. Surimi development, for the Japanese market, appears to be a more promising activity at this time. In any case, the resource is so abundant that serious recommendations have been made to develop this as a high-volume, low-priced, industrial fishery. A large amount—probably 400 million pounds or more—is now being demonstrably wasted through being discarded by shrimp fishermen from their trawler operations.

Basic technology for producing croaker surimi in the U.S. is available, although exacting Japanese product specifications (flavor, color, texture, etc.) may be difficult to meet. NMFS personnel in the Southeast Region are examining these problems.

Figure 8.—Pacific hake caught by U.S. fishermen is primarily used for the production of pet foot. There is a sizable traditional market for hake as a food fish in most Mediterranean countries, where it is known as a choice fish.

Eels

Small shipments of eels from the U.S. are going to Europe. In Italy eels bring 30 cents per pound at wholesale. Eels are little used in the United States, although the resources are substantial. There are export possibilities for both live eels and frozen products. United States landings of eels amount to about 2 million pounds per year—with a landed value of about $400,000. The potential catch is not known, but it is undoubtedly considerably greater than at present.

Technological problems with this product are mostly present in developing an acceptable product for Japanese markets. Cultured eels, sold alive, are preferred in Japan and U.S. eel culture does not yet exist. European product standards are less rigorous but lack of knowledge on eels is a major obstacle. NMFS and the states of North Carolina and Florida are examining approaches to European and Japanese markets.

Silver Hake and Pacific Hake

The silver hake (called whiting in New England) resource off New England is being utilized heavily by foreign fleets, U.S. effort is also substantial, with probable room for expansion. The silver hake fishery in ICNAF subarea 5 (New England and Georges Bank) may be able to sustain an annual catch in the order of 660-880 million pounds. The average annual quantity extracted from this fishery over a recent 5-year period (1965-1969) was about 332 million pounds (Gulland, 1971).

The Pacific hake resource extends along the Canadian/U.S. coast between Queen Charlotte Sound in Canada and Baja California. Only the Soviets operate in this fishery in earnest, although its maximum sustainable

yield is estimated at 210,000 metric tons per year (FAO, 1972).

U.S. fishing for Pacific hake is currently limited to a Puget Sound fishery that is geared to pet food production. The species has characteristically soft flesh but, unlike silver hake, an organism frequently occurs in Pacific hake which causes a protein breakdown and consequent further softening of the flesh during storage. Pacific hake, nonetheless, is highly edible, although there are technological problems with regard to processing hake for human food. There is a sizeable traditional market for hake in most Mediterranean countries where it is known as a choice fish.

The two currency devaluations may provide the price advantage needed for the United States to compete in European markets. Frozen h. & g. (headed and gutted) silver hake, for example, produced in New England, sells (wholesale) in the range of 25 cents to 35 cents per pound, depending on package size, f.o.b. Boston area. This item has been bringing about 22 cents to 29 cents per pound in Italy, and the U.S. product has not been competitive. The "devalued" price, however, will be more attractive. Also, in Italy, there is a strong demand for fresh hake, at prices up to $1.09 per pound, which appears high enough to warrant absorbing air transportation costs. In addition to Italy, silver hake are regularly sold in markets in the U.K. and West Germany. Spanish interests now appear eager to find new sources of supplies to satisfy growing demand in their country, and have been looking into the possibilities for establishing connections with suppliers of Pacific hake.

Atlantic Mackerel

Mackerel stocks in the Northwest Atlantic are being regulated through a quota system, under ICNAF. The potential yield for mackerel in this area is estimated at above 600 million pounds annually. ICNAF data indicate a sharp upturn in effort in this fishery over the last few years, and high catches have approached (some say, have gone over) the limit of the estimated potential, although catches have fluctuated. The U.S. participation in this fishery is practically nil. Mackerel was formerly one of the leading species landed by New England fishermen. The peak years were during 1820-1880 when yearly landings were in the order of 90 to 170 million pounds, and again in the 1940's when landings ranged from 50 to 60 million pounds. Subsequently, the schools of mackerel disappeared from known areas and the U.S. catch dwindled to about 2 to 3 million pounds. Apparently, the mackerel are now available, but the years of absence practically destroyed their marketability in the U.S. Present U.S. catches average about 8 million pounds per year. The U.S. quota for 1973 is 26,000 tons (57 million pounds).

Atlantic mackerel represent an export opportunity, although the benefits of devaluation in this case are not so clear. There are established markets for mackerel in major European countries at relatively low prices. Whole, frozen mackerel brings in the range of 10 cents to 20 cents per pound in European markets. This would be a difficult range to compete with for U.S. producers, but the disadvantage could be overcome by marketing the species in a different product form.

Figure 9.—Worker cracks California sea urchins so that the valuable roe can be extracted. There are large foreign markets for sea urchin roe.

Mussels

Mussels are excellent food and are consumed in large quantities in Europe and other parts of the world. The U.S. is an exception, however. Despite the existence of sizeable resources, the U.S. harvest is extremely modest. In meat weight, the U.S. catch runs about 1 million pounds, with an average value of about 10 cents per pound. This low price reflects the relatively weak demand in the U.S. for mussels, compared with other shellfish.

Spain and France, in Europe, are heavy importers of mussels—several millions of dollars worth yearly. The price per pound is not overly attractive, at present, in terms of probable U.S. production costs and considering transportation costs from the U.S. A different product form, canned or frozen, for example, might be introduced into

these European markets and receive a favorable reception wherever mussels in some form are a traditional food.

Sea Urchin

Sea urchins constitute one of the brighter prospects for underutilized fisheries development. There is a large, although undetermined, population of sea urchins off California and on the Atlantic coast. The development of a sea urchin fishery in southern California is particularly logical. The harmful effects of sea urchins to the marine communities call for a reduction in their numbers. Further, a large market is available in Japan, and possibly in Europe and the U.S. as well. Small-scale fisheries for sea urchins have sprung up sporadically in California and have existed for many years in Maine. However, no attempt had been made to initiate a large-scale fishery for the domestic markets or to develop an export trade.

Recently NMFS has taken a leading role in helping to develop a fishery. NMFS personnel taught potential suppliers how to process the roe, helped obtain preliminary data on processing costs, supplied samples of the product to potential buyers, and brought sellers and buyers (predominantly Japanese) together. Since October, 1972, approximately 25,000 pounds of sea urchin roe have been shipped by airfreight to Japan from California. Two new roe processing plants are planned in California.

Japan now consumes about 2.6 million pounds of sea urchin roe per year. Given the growing Japanese demand for roe, they would be highly receptive to a new source of supply of sea urchin roe. Prices in the Japanese market are attractive. Sea urchin roe now brings about $2.25 per pound and up. A modest harvest in the U.S.—in the order of 4 to 5 million pounds of sea urchin—could develop into a million dollars plus in export sales.

Canada is now exporting sea urchin roe to Japan, and since October, 1972, Canada has shipped 20,000 pounds of roe and 36,000 pounds of live sea urchins to Japan. Other suppliers include Mexico, Chile, and possibly, in the near future, the Peoples Republic of China.

Harvesting and extracting sea urchin roe is a manual operation. No other technological restraints appear to exist and product requirements for Japanese market have been developed.

Alaska Pollock

Alaska pollock represent one of the most abundant of the world's commercial fishery resources. Much of this resource is in waters adjacent to Alaska. U.S. fishermen, however, have not sought Alaska pollock in any great degree, and almost the entire catch throughout the northern perimeter of the Pacific Ocean has been taken chiefly by the Japanese, the Soviets and Koreans.

The non-U.S. fishing pressure on the pollock resource is heavy, although scientists believe that the pollock resource in the Gulf of Alaska is virtually untapped (Alton and Nicholl, 1973). It is estimated that the Gulf of Alaska would sustain a catch of about 25,000 metric tons yearly (55 million pounds).

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MFR PAPER 992

Deboned meat from fish frames, mixed with ground choice beef and flavoring, makes...

Beefish Patties

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ABSTRACT

At present, ground meat can be obtained from fish frames or headed, gutted fish but it is underutilized in existing seafood products. Trying a different approach, we mixed it with ground beef and seasoning, in varying proportions, to make beefish patties.

Sensory evaluations indicated that beefish patties are just as acceptable as all-beef patties in appearance, odor, flavor and texture. Economic and nutritional considerations were not part of these evaluations but these factors would influence final consumer acceptance. The potential value of this new product suggests the desirability of expanding further development work.

INTRODUCTION

Ground beef (hamburger) patties have become a popular item in the American diet. Hamburgers are well known in institutional or commercial mass feeding situations and in domestic homes. Most consumers also recognize that ground beef represents a higher degree of utilization of a beef carcass than would be possible if only beef steaks and roasts were utilized.

Fish fillets have also become established in the American diet. Fillet sections are called steaks, but their appearance, flavor, and texture are obviously different from beefsteaks. Another difference between beef and fish is that the leftover parts of a fish carcass, after fillets have been removed, are underutilized as a source of ground or minced flesh.

In recent years, several groups have become interested in using meat-bone separators to obtain edible flesh from various underutilized sources. For example, machine-separated flesh can be obtained from "V-cuts" (a mixture of fillet meat and small "pin" bones obtained by trimming fillets to remove these bones). Although this minced fillet meat is made into an inexpensive type of fish stick, it represents an increase of only 2 percent or so in meat recovery from a fish carcass. Much higher increases of meat recovery, in the order of 20 percent, can be obtained from fish frames (carcass minus head, viscera, and fillets). Despite a potential tenfold increase in meat recovery, deboned meat from fish backbones is not generally used for making fish sticks.

The principal drawback to the present use of deboned meat from fish frames for making fish sticks is that fish sticks are generally recognized as a white-meat product. Fish frames contain blood-rich tissues under the spinal column even in species such as cod, haddock, and pollock which have practically no visible blood pigmentation in their fillet meat. This pigmentation will colorize machine-separated meat in proportion to the amounts of blood-rich tissues and unpigmented tissues in the material being fed to a meat-bone separator. Special decolorization treatments are being researched, but these treatments would increase production costs or reduce yield of the ground fish flesh.

A second problem in utilizing fish frames for manufacture of fish sticks is that the frames contain pieces of skin and membranes. These pieces can be removed by a deboning machine which has a fine-mesh screen, but the texture of the recovered flesh is much less fibrous than the flesh obtained from V-cuts. Consequently, fish sticks made from this source have a less desirable texture than fish sticks made from minced fillet meat (V-cuts).

Similar problems are encountered when using headed and gutted fish to recover edible flesh with meat-bone separators. This source of material also contains blood pigments as well as skin and membranes. The color problem in minced flesh obtained from headed and gutted fish is often not as severe as in minced flesh from frames. If the skeletal muscle ("fillets") of a headed and gutted fish is reasonably devoid of visible pigmentation, this flesh can "dilute" the coloration from the spinal blood-rich tissues in the machine-separated flesh. The other problem, pieces of skin and membrane, can be overcome using a strainer type of separator, but again the texture of the recovered flesh is

much less fibrous than the flesh obtained from V-cuts.

Instead of trying to alter the characteristics of ground meat from fish frames or headed and gutted fish to suit fish stick requirements, we took this meat "as is" and sought suitable product applications. Its sensory qualities, its nutritional and economic values, suggested product combinations with pigmented mammalian meats would be worth developing.

Beef was selected from the mammalian meats for this product development work. Several combinations such as frankfurters, sausages, and recipes using hamburger have been suggested (King and Carver, 1970; King et al., 1971; D. Miyauchi, M.A. Steinberg, and F. Teeny, NMFS Pacific Fishery Products Technology Center, Seattle, WA 98102, pers. comm.). This report describes a simple combination which we have called a "beefish" patty.

MATERIALS AND METHODS

Fish materials were obtained from local processors. Cod, haddock, pollock, or cusk filleting lines provided a source of fish frames. Since these fish had been eviscerated at sea, only the head was removed from these frames. For flounder and ocean perch frames, we had to remove both heads and viscera. Headed and gutted species were whiting, ocean perch, and carp. All fish materials were washed before deboning.

A Bibun meat-bone separator was used with or without the strainer as previously described (King and Carver, 1970; King et al., 1971)[1]. The unwashed minced fish flesh was frozen in waxboard fish block cartons using a plate freezer and stored at 0°F until used. Neither glazes nor additives were used to preserve these blocks.

The ground beef (hamburger) was bought locally. It contained 26-28 percent fat. It was not frozen and was mixed with the fish within 24 hours.

[1] The use of trade names is merely to facilitate descriptions; no endorsement is implied.

The beef and fish were mixed in a Hobart Meat Mixer. When seasoning was used, it was added just before the mixing. This seasoning is a hydrolyzed, plant-protein blend developed by the Nestlé Corporation, Food Ingredients Division, for us; it bore their number NM139-88.

Sensory evaluations were made using standard procedures (Amerine et al., 1965). The initial evaluations were done by a small group of employees of the NMFS Center in Gloucester. Informal evaluations were also made by several participants during two meetings of seafood technologists in New Bern, N.C., and Hamption, Va.

Subsequently, a much larger group of college students evaluated beefish patties in the student union of Virginia Polytechnic Institute and State University (VPI). Each participant was given one of three samples on a hamburger bun: all beef; 71 percent beef, 25 percent fish, 4 percent NM139-88 seasoning; or 61 percent beef, 35 percent fish, and 4 percent seasoning. The students were told that the union was planning to switch meat suppliers and wanted to see which one manufactured the best patty. They were asked to rate appearance, odor, flavor, and texture on a 9-point hedonic scale.

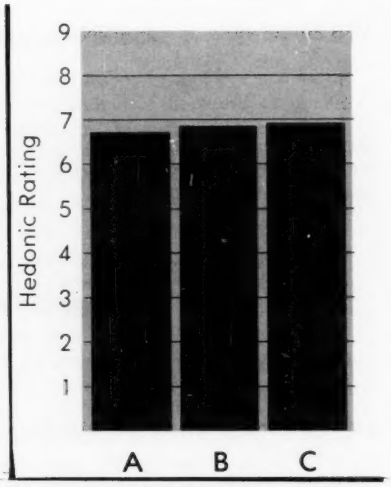

Figure 1.— On a scale of 1 to 9, patties made of (A) all beef; (B) 71 percent beef, 25 percent fish, and 4 percent flavor; and (C) 61 percent beef, 35 percent fish, and 4 percent flavor, all rated almost equally high on appearance, odor, flavor, and texture (see Table 1)

RESULTS AND DISCUSSION

Hedonic results from the large-scale VPI feeding test indicate that beefish patties can be just as acceptable as all-beef patties (Table 1 and Figure 1). The large number of respondents in this test and the fact that the minced whiting had been stored for a year before the test are especially noteworthy. Similar hedonic

Table 1.—Results from Virginia Polytechnic Institute and State University feeding test.[1]

Samples	*Appearance*	*Odor*	*Flavor*	*Texture*
Sample A (all beef)				
Number	30	29	29	30
Mean	6.87	6.55	6.83	6.57
(variance)	1.58	1.00	1.25	2.85
(standard deviation)	1.26	1.00	1.12	1.69
Sample B (71% beef, 25% whiting, 4% plant protein flavor)				
Number	56	56	56	56
Mean	6.96	6.77	6.61	7.09
(variance)	2.14	2.53	4.56	1.69
(standard deviation)	1.46	1.59	2.14	1.30
Sample C (61% beef, 35% whiting, 4% plant protein flavor)				
Number	56	56	56	56
Mean	6.80	7.00	6.89	7.00
(variance)	1.87	1.36	2.49	2.39
(standard deviation)	1.37	1.16	1.58	1.55

Overall Means $\frac{\Sigma(A+O+F+T)}{4}$

Sample A = 6.71
Sample B = 6.86
Sample C = 6.92

[1] Based on a 9-point hedonic scale as described by Amerine et al., (1965).

results were obtained by the Gloucester group under different testing conditions and using other kinds of fish in the patties.

The Gloucester group of evaluators also participated in a series of triangle tests to determine suitable proportions between the ingredients of beefish patties. On the basis of their results (Table 2), it appears that the proportion of fish flesh can vary from about 25 percent to about 50 percent without changing the overall acceptability of a beefish patty. These results and other (unpublished) hedonic results indicate a preference for including the hydrolyzed plant protein seasoning, NM139-88, compared with no seasoning at all. Our experience also indicates that the optimum use level of this seasoning may vary between 1 and 4 percent depending on the fish material used and the people doing the evaluation.

Although the beefish patty has an acceptability equal to an all-beef patty, it is a separate product. Taste panelists have had little or no difficulty distinguishing between the two products when served both at the same time. However, these taste panelists found that one can be used in place of the other with no loss in acceptability. Although some of these evaluations were based on frozen-stored fish ingredient, none were based on frozen-stored patties. These evaluations did not include economic or nutritional considerations. Final consumer acceptability of a beefish patty would be influenced by these considerations as well as its sensory quality.

Table 2.—Results of triangle test comparisons of beefish patties containing various amounts of machine-separated flesh obtained from haddock frames and ground beef with or without hydrolyzed plant protein seasoning, NM139-88.

Samples Compared (Beef and Fish ratios based on weights of each when mixed. Seasoning amounts expressed as percentage in the final mixture of beef, fish, and seasoning.)	Significant Majority of Evaluators Made Correct Choice (p=.01 or less)	Preference of Majority Who Made Correct Choice
All beef vs. Beef/Fish: 75/25	Yes	All beef
Beef/Fish 75/25 vs. 50/50	No	—
Beef/Fish 50/50 vs. 25/75	Yes	Beef/Fish 50/50
Beef/Fish 50/50 without Seasoning vs. Beef/Fish 50/50 with 2% Seasoning	Yes	Beef/Fish with 2% seasoning
Beef/Fish 50/50 with 1% Seasoning vs. Beef/Fish 50/50 with 2% Seasoning	No	—
Beef/Fish 50/50 with 2% Seasoning vs. Beef/Fish 50/50 with 4% Seasoning	No	—

CONCLUSIONS

Mixtures of ground beef and fish (beefish) have enjoyed good acceptability when tried as patties. (The ground fish component was obtained from sources presently underutilized for food.) These results, together with economic and nutritional considerations, lead us to suggest the value of continuing development work on this product. Both technological and marketing research are needed to properly assess its potential.

ACKNOWLEDGMENTS

Assistance in providing the Bibun equipment and its use was given by Mr. Georges Vedie, Food Masters, Inc., 253 Summer Street, Boston, MA 02210.

Mr. Thomas Kinney, Mr. Gary Wheelock, Mr. Howard Pease, Mr. Ernest Reutimann, Mr. H. Peale Haldt, and Mr. Peter Chaplinsky, The Nestlé Company, 100 Bloomingdale Road, White Plains, NY 10605, helped us evaluate the suitability of hydrolyzed plant protein seasoning NM139-88 in beefish patties on several occasions.

Financial assistance for part of this work was provided by the Office of Sea Grant, NOAA, USDC, Rockville, MD 20852, to Virginia Polytechnic Institute and State University.

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MFR Paper 992. The paper above is from Marine Fisheries Review, *Vol. 35, No. 7. Reprints of this paper, in limited numbers, are available from D83, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235.*

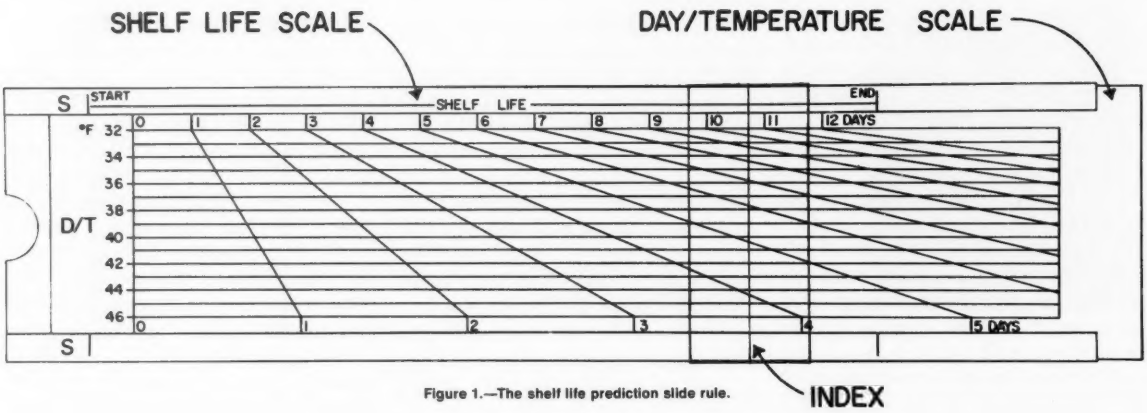


Figure 1.—The shelf life prediction slide rule.

Slide Rule for Predicting Shelf Life of Cod

L.J. RONSIVALLI, ROBERT J. LEARSON, and S.E. CHARM

INTRODUCTION

The slide rule described in this article is based on the publication by Charm et al. 1972. According to that publication, the spoilage of cod occurs at a constant rate for any given temperature in the range of 32°F to 46°F. When the spoilage rate constants were plotted versus the temperature, a linear relationship was suggested. This agrees with findings by others (Spencer and Baines, 1964, and James and Olley, 1971). Charm et al. also found that when cod fillets were stored under conditions of varying temperatures, the spoilage rate constants were unaffected when the sequence of storage temperature was varied.

These findings clearly indicated that a device for predicting the shelf life of cod fillets is possible. The slide rule should be useful to anyone concerned with distribution and handling of fresh fish. It emphasizes the advantage of maintaining the product at as low a temperature as possible. The slide rule predicts the quality of fish in terms of "days held in ice."

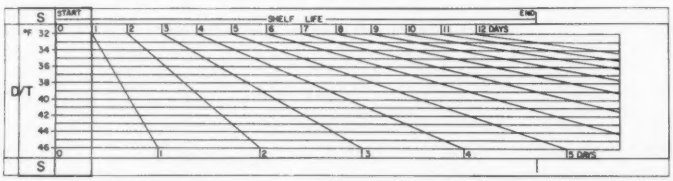
The slide rule shown in Figure 1 has three parts: 1) the day/temperature (D/T) scale, 2) the shelf life (S) scale, and 3) the index. Note that the temperature lines are horizontals and that the day lines are diagonals. The slide rule should *only* be used when the history of the fish is known or can be estimated fairly accurately.

L.J. Ronsivalli is Acting Center Director, NMFS Atlantic Fishery Products Technology Laboratory, Gloucester, MA; R.J. Learson is a Supervisory Research Food Technologist, NMFS Atlantic Fishery Products Technology Center, Gloucester, MA; S.E. Charm is Director, New England Enzyme Center, Tufts University School of Medicine, Boston, MA.

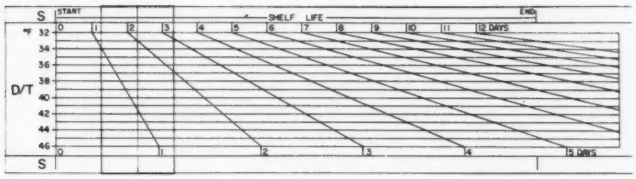
OPERATION

To illustrate its use, the following example is given:

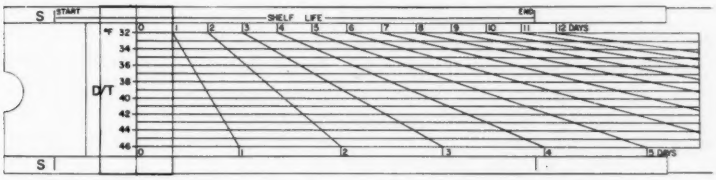
Problem: Suppose fillets were cut from fish that had been held in ice aboard a vessel for two days and then stored in a cool room at 40°F for one day. What would be the shelf life of the fillets in a refrigerated showcase held at 46°F?



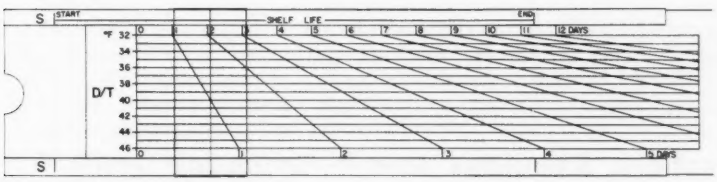
Step 1. Set start of S scale and index line over O and D/T scale.



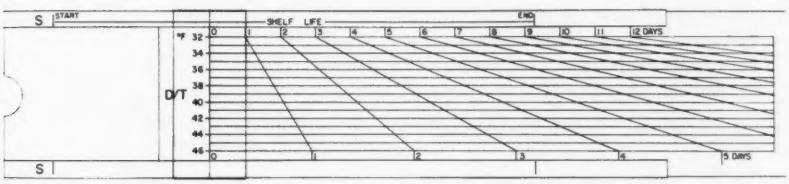
Step 2. Slide index line over point where two-day line crosses 33°F line. (Our data indicated that the temperature of iced fish is about 33°F).



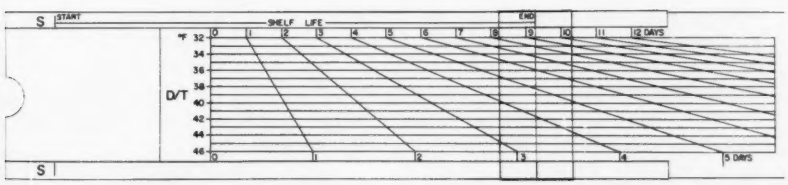
Step 3. Slide D/T scale to right until O on D/T scale is under index line.



Step 4. Slide index line over point where one-day line crosses 40°F line.



Step 5. Repeat step 3.



Step 6. Slide index to right until index line is at end of shelf life on S scale. At point where index line crosses 46°F line on D/T scale, we see that answer to problem is a little more than three days.

Note that when step 6 is reached, the shelf life remaining at any temperature shown can be read under the index line.

It is worthwhile to point out once more the benefit of holding fish at as low a temperature as possible. Note that the fillets cited in the problem above would have about twice the shelf life by holding them at 35°F.

Except by only a slight chance, day lines will not intersect exactly the point where the index scale intersects the 46°F line (or any of the temperature lines); therefore, one has to select the nearest day line or estimate fractions of a day.

Although the slide rule is specifically for cod fillets, our experience indicates it is just as useful for eviscerated whole cod and for eviscerated whole haddock and haddock fillets. In fact, it should be useful for most lean fish since the variability in spoilage rate constants among lean species should not be significant.

The slide rule was developed with Federal research funds, and there is no restriction as to its use by the public. Anyone having questions or needing assistance in the fabrication of the slide rule is requested to contact the authors at the Atlantic Fishery Products Technology Center, National Marine Fisheries Service, National Oceanic

and Atmospheric Administration, U.S. Department of Commerce, Emerson Avenue, Gloucester, Massachusetts 01930.

ACKNOWLEDGMENT

The authors are pleased to acknowledge the work of Mr. Paul Earl, Visual Information Specialist, Extension Division, National Marine Fisheries Service for the fine drawings which facilitated the job of instructing in the operation of the slide rule.

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MFR Paper 993. The paper above is from Marine Fisheries Review, *Vol. 35, No. 7. Reprints of this paper, in limited numbers, are available from D83, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235.*

NOAA/NMFS Developments

Sportfishermen, Researchers, Satellites Join in Gamefish Study

A fleet of privately-owned sportfishing craft, several scientific research vessels, two refueling platforms, and two orbiting satellites rendezvoused in and over the northeast Gulf of Mexico in June to collaborate in a unique study of the ecology of ocean gamefish.

Work began June 15, 1973, when about 50 sportfish boats put to sea to take part in the "Old Salt" fishing tournament, about 100 miles off the Florida "Sun Coast" (Crystal River south to Fort Myers).

Participants included many bluewater fishermen, several components of the Commerce Department's NOAA, the National Aeronautics and Space Administration, about a dozen academic institutions, and several business firms.

Dates for the event are June 15-18, July 20-22, August 24-26, and September 14-16. The planners will take advantage of information from NASA's ERTS-1 (Earth Resources Technology Satellite) to define the fishing area. The four-part event is sponsored by the non-profit Gulf Oceanographic Development Foundation of Florida, and the coordinator is the State University System of the Florida Institute of Oceanography. Financial profit from entrance fees in the tournament is used to support gamefish research at Florida universities.

The end result is expected to indicate whether expanded usage of scientific programs employing space technology can help NOAA—and through it the sportfishing fraternity—toward a better understanding of recreational fishing resources in the United States. Theoretically, satellite inspection of great stretches of the ocean may reduce some of the guesswork about where the big fighting fish congregate by directing fishermen to favorable locations. An auxiliary result could be an increase in the efficiency of research vessels engaged in oceanographic surveys at the sea surface.

Marine science is served in a variety of ways during the Old Salt tournament. Fishermen station their boats along the eastern edge of an oceanic feature called the "Loop Current," a fast-moving "river" of tropical water that attracts great quantities of gamefish—marlin, sailfish, tuna, wahoo, dolphin, and others—as it flows through the Gulf. A rich supply of nutrients washes into the region with the current, which becomes a gigantic feeding station for fish of all sizes. Preliminary oceanographic investigation of the surface and sub-surface fixes the variable location of the current for fishermen. Gamefishermen keep daily logs of catches, fish hooked and sighted, and weather and water conditions encountered.

Catches, by prior agreement, are contributed to marine scientists, who seek to understand the relationship between fish populations and oceanographic features. The NOAA research vessel *Oregon II*, under the direction of the National Marine Fisheries Service Southeast Fisheries Center, Miami, Florida, stood at anchor at the fishing site to serve—for the third year—as mothership and floating laboratory for the fleet of anglers.

Aboard the *Oregon II*, the scientific

party weighed and measured trophy fish; examined and recorded biological characteristics of caught fish; preserved whole specimens or anatomical samples for later analysis of various factors related to life forces, migratory patterns, and incidence of heavy metals and pesticides in marine animals; and compiles logbooks of oceanographic circumstances before and during the tourney. The scientists have even developed a special sampling system for those anglers who wish to mount their catches —dissection procedures are confined to one side of the fish; the other side is left intact.

The research vessel *Virginia Key* from NOAA's Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida, conducted preliminary surveys of Gulf waters to be studied during Old Salt. The Laboratories' studies of the Loop Current are part of a larger investigation of the application of satellite technology to oceanography.

ERTS-1 and NOAA-2 (the National Oceanic and Atmospheric Administration's operational environmental satellite), orbiting at 570 and 900 miles over the earth, will repeatedly focus banks of scanners on the fishing site. ERTS-1 provides coverage of the Gulf once every 18 days, and NOAA-2 views the area twice daily. Oceanic features, such as the edges of major currents, can be detected by interpreting information on their shape, color, and temperature transmitted from the versatile sensing systems aboard the unmanned space vehicles. In earlier experiments, scientists at NOAA's NMFS laboratory at Pascagoula, Mississippi, were able to link satellite and aircraft-acquired data to the location of schools of menhaden (an important commercial catch) in the Gulf of Mexico.

The surface data collected by satellite and the oceanographic data—salinity, temperature, depth, sea-state weather, movement of current, observations of fish—will be coordinated and compared at experiment's end. Biologists, oceanographers, physicists, and computer experts will analyze all data in attempts to relate those environmental factors to the distribution and availability of oceanic game fish. Findings will be conveyed to sport fishermen in comprehensive forms and made available to other users through the facilities of NOAA's Environmental Data Service.

Fishing equipment donated by manufacturers were tested during the Old Salt tournament. This includes rods and reels designed to handle the heavy fish often boated from great depths near the Loop Current, and electric-powered reels, both to be used by scientists aboard fishing boats to catch additional specimens for scientific purposes. (The newly developed motorized reel is particularly useful to disabled fishermen whose enthusiasm for big-game fishing has not dimmed.)

The two refueling boats, stationed about 60 miles offshore at the 30-fathom curve, are 65 feet long and each carries 3,000 gallons of fuel. Those facilities are used by fishing boats whose fuel capacitiy is too small to accommodate the large amounts needed for the three-day tournament and the 100-mile or more ride to shore.

The 1973 Old Salt tournament was the third such event. Last year 47 boats participated in the 4-day tournament and caught 3 blue marlin and 18 sailfish, along with numerous wahoo, dolphin, and blackfin tuna. Three blue marlin were hooked but lost. (One, estimated to have weighed 400-600 pounds, broke the line after a 6-hour fight.) Fishing on the inshore reefs netted several thousand pounds of black and red grouper and red snapper. The large amount of biological and oceanographic data acquired in the 1972 and 1971 tournaments have been processed and analyzed by several marine laboratories and will definitely influence procedures and methods used in the 1973 fishing expeditions.

Source: Department of Commerce News, NOAA 73-116.

New York Bight Atlas Planned

State University of New York has been awarded a $125,000 Sea Grant to prepare a comprehensive preliminary atlas of the marine environment of the New York Bight, the Commerce Department's NOAA has announced. Preparation of the atlas is part of a concentrated study of the bight area planned under NOAA's Marine Eco-Systems Analysis (MESA) program.

The atlas, through text and graphics, will provide basic information on the region that is needed by Federal, state, regional, and local governmental agencies, by industry and commerce, and by citizens' groups concerned with the area's marine environment. When published, the atlas material will be made available through NOAA to decision-makers in the region.

During the five-year New York Bight study program, NOAA and a number of other agencies will monitor and describe the physical, chemical, and biological processes of the marine environment, provide information and expert advice needed for effective management of the area, and analyze the impact of manmade alterations and natural phenomena on marine ecosystems.

The New York Bight was selected for the MESA project because it is an area of heavy environmental impact by population and economic development, and because of critical management decisions involved in the area's development.

The New York Bight, for purposes of these studies, comprises the coastal and estuarine environments from Montauk Point, Long Island, to Cape May, N. J., extending seaward to the edge of the Continental Shelf and landward to the limits of tidal effects, but excluding Long Island Sound. This includes those adjacent lands which have a direct and significant impact on coastal waters.

Source: Department of Commerce News, NOAA 73-110.

New Product May Lower Seafood Costs

A new kind of fish product will become increasingly available to consumers and is expected to be lower in cost than other similar seafood items, NOAA has announced.

"Minced fish" is the officially announced name of the commodity. The product, said Robert W. Schoning, Acting Director of NOAA's NMFS is as pure and nutritious as higher graded cuts, but processed differently. Minced fish is the result of several years of cooperative experimentation by industry and NMFS fishery scientists and technologists. Their objective was to perfect machine techniques used to strip meat from bones so that formerly wasted pieces of edible flesh could be recovered and formulated into wholesome marketable forms, attractive to shoppers. (See page 33 of this number of *Marine Fisheries Review* for an account of one proposed use of minced fish.)

Most of the minced fish thus produced will be pressed into large fish blocks, manufacturers say, which can be processed into a variety of items for sale at frozen food counters. These include fish portions cut from blocks of minced fish, for direct use or as the main ingredient in frozen fish dinners, fish sandwiches, or casserole-type entrees. Food processors also are experimenting with new kinds of products that can incorporate the easily handled minced fish into composite items—fish mixed with potatoes, fish in spreads or dips, or several kinds of minced fish mixed together or with other ingredients to produce exciting new flavors. An added advantage of the mincing process is that the machines are geared to extract meat from kinds of fish whose small size or bony anatomy make it impracticable to process them on machines built primarily for filleting fish. Canning companies, too, can be expected to take advantage of the new product.

According to labeling requirements published by NMFS in the *Federal Register* May 12, 1973, all products manufactured from minced fish under Department of Commerce inspection procedures must be so designated in clear type following the name of the sale item. In short, the words "made from minced fish" must follow a term such as "fish sticks" or "fish portions."

Source: Department of Commerce News, NOAA 73-125.

BOWHEAD WHALE RESEARCH TO CONTINUE

Dr. Robert M. White, U.S. member of the International Whaling Commission and Administrator of the Commerce Department's National Oceanic and Atmospheric Administration, said today that NOAA has taken steps to ensure continuation of ongoing research on bowhead whales, recognizing the importance of these whales to Alaskan Eskimo communities.

Dr. White said a contract has been signed with the University of California and Dr. Floyd Durham, who has worked with bowhead whales and the Eskimo people in the Alaskan Arctic for the past decade. Dr. Durham's studies are believed to be the only U.S. research of its type being done on bowhead whales.

Personnel from NOAA's NMFS are working with Dr. Durham this year to assure a smooth transition when he retires from this phase of his work later this year.

Source: Department of Commerce News, NOAA 72-123.

Porpoise Program Manager

Dr. Eric G. Barham, 53, former head of the Marine Biology Branch of the Ocean Sciences Department at the Naval Undersea Warfare Center in San Diego, has been named Porpoise Program Manager at the NMFS Southwest Fisheries Center, La Jolla, California. He will direct and coordinate a new NMFS research program to study porpoise and tuna reactions in the tuna fisheries of the eastern tropical Pacific.

Barham

Born in Panama City, Panama, Dr. Barham received his B.S. degree with honors in zoology from San Diego State College in 1950, and his Ph.D. in biology from Stanford University in 1957. He was formerly an associate professor of biology at San Diego State.

In his work with the Navy, Dr. Barham worked on research dealing with basic information for an underwater acoustics program. He is internationally recognized as an authority on the deep scattering layer and the bio-acoustics in the ocean and has pioneered in biological research from bathyscaphes and other deep diving research vehicles.

Source: Department of Commerce News, NOAA 73-47

PATENT ISSUED

The NMFS Pacific Fishery Products Technology Center, Seattle, has received the inventor's copy of U.S. patent No. 3,726,689, "Animal Food from Raw Whole Fish," issued to Max Patashnik, of the Center Staff. This patent, assigned to the United States, is the second one issued for the process studies in which the laboratory showed how the solubility and gelling characteristics of raw fish can be used to produce an animal food or fish bait with flavor, texture, and stability modified to suit user needs. There has been a continuing commercial interest in the future potential of this work. Small-scale commercial applications have already developed.

The Center has now had six public service patents issued in recent years —the two referred to above, one on an aqueous process for producing protein concentrates, one on a mechanical scallop-shucker, and two on chemical intermediates from fish oil. Two patent claims are still pending.

Fishermen and Scientists Track Sharks

More than 10,000 sharks travel through the Atlantic Ocean adorned with bright red, yellow, and blue decorations bearing messages in five languages, courtesy of private and Federal scientific establishments and sport fishermen.

Shark-tagging is but one of the many tools used by marine scientists in the Commerce Department's NOAA to chart the migrations of a variety of wide-ranging deep-water fish prized by big-game anglers. The shark-tagging project, carried out since 1964 at NOAA's NMFS Narragansett (R.I.) Laboratory, is the most extensive such program in the world. Under the direction of biologist John G. Casey, it is closely integrated with billfish and tuna tagging studies conducted at the Woods Hole (Mass.) Oceanographic Institution.

To date, 10,500 sharks have been caught, tagged, and released. Returned tags from recaptured sharks number 335, these from 11 species including blue, sandbar, and mako sharks. To date the maximum distance covered is 2,070 miles by a blue shark (New England to South America); the maximum time between tagging and recapture is over 7½ years for a sandbar shark. Tags have been returned from commercial fishermen of 18 foreign countries (35 percent of total), and U.S. sport and commercial fishermen (65 percent).

Among the preliminary, but potentially significant, findings from tag returns are:

- that the blue shark is an inveterate traveler, moving 1,000 or more miles annually, from the northeast U.S. coast to as far south as Guyana, and sometimes across the Atlantic Ocean;
- that blue sharks, mako sharks, and white marlin (and perhaps swordfish as well) follow similar migratory routes;
- that migratory routes of male, female, and juvenile segments of some shark populations differ and change as the sharks increase in size;
- that some sharks may be much longer lived than had been previously supposed. For example, a specimen tagged at three feet and estimated to be three or four years old, had grown only twenty inches and was still immature when recaptured after seven years at liberty. Another, tagged at six feet, showed no measurable growth seven years later.

The NOAA program is based on the premise that investigations of shark populations can yield quantities of data important to marine science, to sport and commercial fisheries, and perhaps to economic planners. Though man's attention has been captured by large sharks since the beginning of time, surprisingly little exact knowledge about shark species is available. For instance, nobody knows how long most species of shark live or how fast they grow; information about how far and fast different sharks travel is imprecise. An accurate census of shark populations has never been taken, therefore the effect on the marine environment of substantial shark harvests customarily taken in many parts of the world cannot be measured. An opposite effect is of interest to U.S. scientists in view of the almost virgin status of shark stocks in such regions as the western North Atlantic (the U.S. east coast), in contrast to other species that have been heavily diminished by fishing.

Added knowledge of sharks and their habits is of interest not only to research scientists, but also to sportsmen who enjoy catching them in ever-increasing numbers, to the commercial fishermen who supply foreign markets, and to students of potential fisheries resources in the United States. The many sharks available in U.S. waters represent an enormous but untapped source of nutrition.

The shark tagging program depends largely on the cooperation of fishermen, primarily along the Atlantic and Gulf coasts, who receive instructions and tagging materials from the Narragansett Laboratory. Volunteers are advised of the species of interest (described in detail in an accompanying angler's guide)—blue, mako, porbeagle, sandbar, dusky, bull, blacktip, spinner, hammerhead, thresher, and sand sharks. Detailed and diagrammed are methods used to implant a dart tag under the skin on the animal's back in a quick and painless manner. (A small plastic capsule containing a number and message on how to return the information trails from the fish at the end of a brightly colored plastic string.) The fish trackers report back on each tagging event, and newsletters from theNMFS laboratory keep participants apprised of findings and developments. Shark tagging also is done from scientific research vessels and a few commercial shark boats.

Program managers say that cooperation by fishermen and general progress have been encouraging, but that more information is required before the migratory patterns emerging for sharks can be precisely fitted into other phases of the broader scaled NMFS investigation of the biology and life history of oceanic game fish, of which the shark tagging project is a part.

Source: Department of Commerce News, NOAA 73-113.

Fishes Shown in New Color Chart

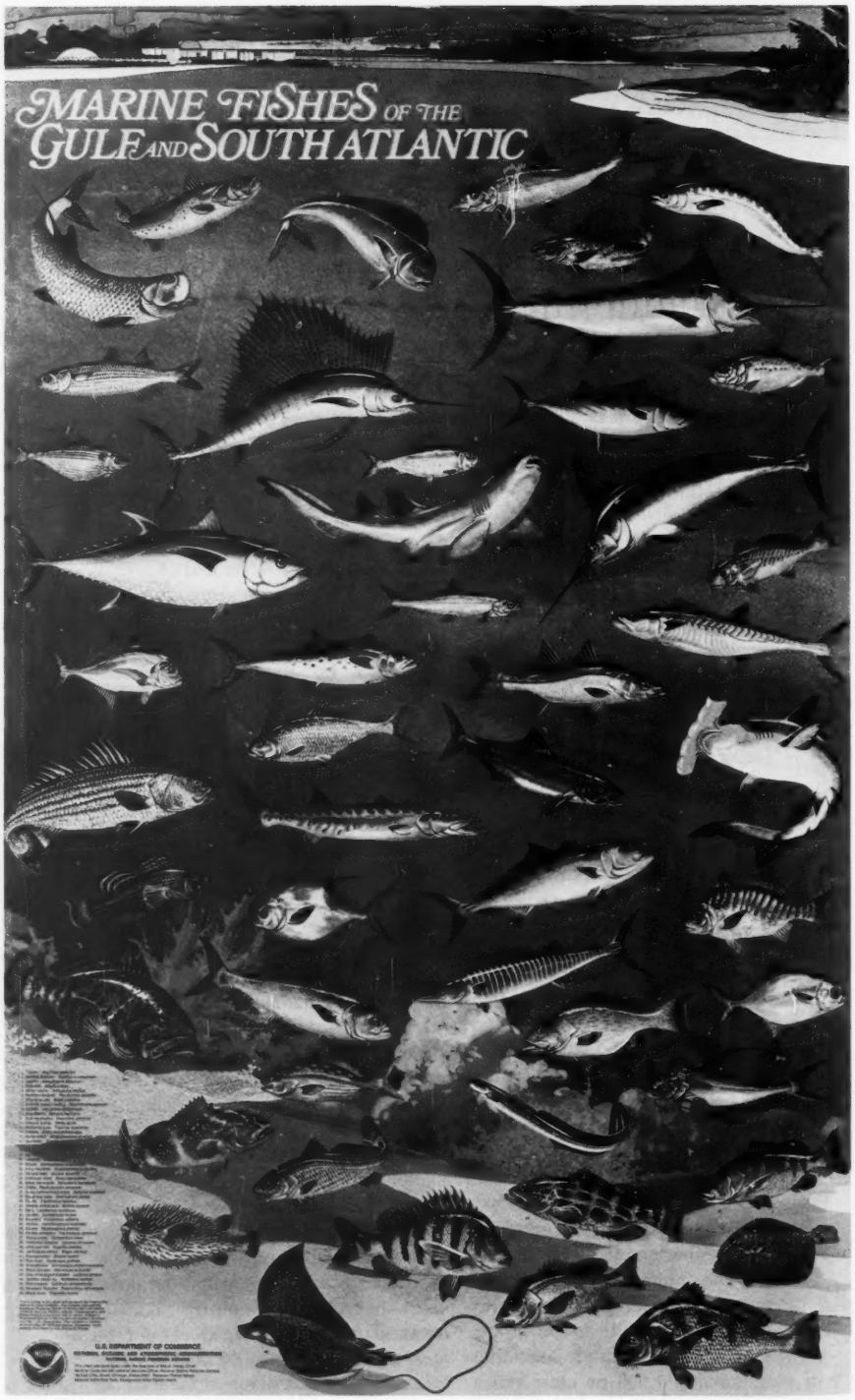
A new four-color poster displaying 49 marine fishes of the South Atlantic Ocean and the Gulf of Mexico is available. It is the fourth in a series of fish posters depicting aquatic inhabitants of U.S. waters that was developed by Bob E. Finley, Chief of the NMFS's National Consumer Educational Services Office, in Chicago, Ill.

Copies of the new poster were presented by Dr. Robert W. Schoning, Acting Director of the NMFS, to industry leaders attending the joint annual meeting of the Southeast Fisheries Association and the Shrimp Association of the Americas in Tampa, Fla., on June 15.

Like the three earlier charts (devoted to fishes of the North Atlantic, of the North Pacific, and to species found off southern California and Mexico) the 30-by-48-inch charts are printed on washable nonglare plasticized paper that hangs flat against a surface without curling. A list of common and scientific names of the fishes is included, as well as artwork that shows seafloor life common to the region.

All four charts are available from Government bookstores and the Superintendent of Documents, Washington, D.C. 20402. The price of each chart is $2.00.

For the fish chart series, The National Consumer Educational Services Office has been awarded a "Mark of Excellence" for superior craftsmanship and skill in pursuit of graphic communications by the Kimberly-Clark Corporation.



Poland-U.S. Fishery Agreement Signed

Warsaw—Representatives of the United States and Poland signed in Warsaw on June 2, 1973, a two-year bilateral fisheries agreement broadening and extending an agreement concluded June 13, 1970, concerning fishing and fishing operations in ocean areas off the Atlantic coast of the United States. The new agreement contains provisions to further conserve stocks of fish of mutual concern, to enhance the exchange of scientific information with respect to these stocks, to minimize fishing gear conflicts between vessels of the two countries and to facilitate the settlement of claims arising from such conflicts, and to provide opportunities for periodic discussions of problems of mutual concern between representatives of the appropriate fisheries authorities of the two Governments and fishermen's organizations.

The new agreement has been expanded to apply to bluefish, lobster, and yellowtail flounder. It also broadens existing protective measures for other species that are important to United States recreational and commercial fishermen.

Protection is continued for scup, flounder, hake, black sea bass, menhaden, and river herring. In addition, bluefish is added to this list of species for which Poland will not fish along the Middle Atlantic coast and for which Poland will minimize incidental catches throughout the year.

The agreement continues the seasonal closure January 1 to April 15 to fishing by all Polish vessels in waters roughly between 50 and 100 fathoms from Rhode Island to Virginia (71 degrees 40 minutes west longitude to 37 degrees 50 minutes north latitude) where bottom dwelling species concentrate early in the year. An additional area generally within the 50 to 100 fathoms contours extending 80 miles further south to 36 degrees 30 minutes north latitude will be closed during the same period to fishing with bottom fishing gear although mid-water gear will be permitted. The latter closure is viewed as an experiment, the results of which may allow Poland to move toward a much wider use of pelagic fishing gear and the possible phasing out of bottom fishing gear in other parts of the Middle Atlantic area.

New assurances are added to the agreement indicating that Polish vessels shall not intentionally catch lobster north of Cape Hatteras, and shall continue appropriate measures to minimize incidental catches of lobster in specialized fisheries for other species, and shall return to the sea in a viable condition all lobster taken incidentally, insofar as possible.

Source: State Department.

REPUBLIC OF KOREA EXPORTS TO U.S. UP THIRD IN 1972

South Korea exported US$36.4 million worth of fishery products to the United States in 1972 (Table 1). The total was $29.3 million in 1971. Most of this was tuna (valued at $31 million) and canned oysters ($3.5 million). The value of ROK's fishery exports to the U.S. increased by 33 percent over similar exports in 1971.

Table 1.—Value of South Korea's fishery exports to the United States, 1971-72

Commodity	1971	1972
	--------US$1,000--------	
Fish:		
Fresh	26,893	31,287
Frozen	367	411
Canned	1,309	3,596
Pickled & salted	19	18
Seaweeds:		
Laver	220	137
Agar-agar	16	24
Other	21	43
Other:		
Fish nets	430	796
Other	57	175
Total	29,332	36,387

South Korea's total world fishery exports were valued at $152,564,000 in 1972 ($114,981,000 in 1971) with the most valuable commodities being: tuna ($68 million), "other" live and fresh fish ($27 million), frozen seafoods ($12 million), fresh squid ($11 million), fish nets ($10 million) and canned seafoods ($5 million). (U.S. Embassy, Seoul, February 8, 1973).

Source: NMFS International Activities Staff.

News from Japan

JAPANESE TO BUY U.S. TUNA CANNERY

The Japanese Mitsui Bussan recently decided to purchase a U.S. tuna cannery located in Puerto Rico. Mitsui is seeking an investment approval from the Japanese Finance Ministry, and as soon as authorization is granted, that firm's U.S.-based Mitsui and Company, U.S. Inc., will take possession of the cannery, which may take place as early as mid-June. Reportedly, the U.S. packer has agreed to sell its business to Mitsui, which has been supplying about one-half of the packer's raw tuna requirement buying about a third of its canned tuna production. ("Suisan Tsushin," May 31, 1973.)

MICRONESIA OPENS PORTS

The Congress of Micronesia, Trust Territory of the Pacific Islands, recently passed legislation which opens seven Micronesian ports to foreign fishing vessels for the purpose of supplying fuel, water and food, as well as to provide recreation to crew members. The seven ports are: Tanapag, Saipan; Tomil, Yap; Malakal, Palau; Moen, Truk; Ponape, Ponape; Jabor, Jaluit; and Darrit, Majuro. Under the Micronesian Agreement, whereby Japan has agreed to extend Micronesia US $5 million for industrial development over a 3-year period, Japanese fishing vessels will be permitted to enter

Micronesian ports after the Japanese government signs a contract to provide production goods and services to that country, which is expected to be around autumn 1973.

The waters off Micronesia are heavily fished by tuna vessels from Japan, South Korea, and Taiwan. About 1,000 Japanese pole-and-line and longline vessels are likely to utilize Micronesian ports for their fishing operations. The Federation of Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN) on May 25 dispatched a survey team to Micronesia to study the feasibility of procuring ship supplies and live bait for its member vessels. ("Katsuo-maguro Tsushin," May 29 and "Shin Suisan Shimbun Sokuho," May 19, 1973.)

FRENCH TUNA CATCH OFF WEST AFRICA INCREASING

The French tuna fleet operating off west Africa in 1972 landed 34,327 metric tons of tuna, according to a recent Japan External Trade Organization (JETRO) report from Paris. This is an increase of nearly 40 percent above the fleet's 1970 catch of 24,729 tons off west Africa and 18 percent over the 29,182 tons taken in 1971. Of the 1972 catch, 37 percent was processed into canned fish for the French domestic market and the rest was exported to the United States and Italy. France reportedly is planning to add 20 new refrigerated tuna vessels to its fleet by 1975. The fleet enlargement is likely to increase that country's total tuna landings to 70,000 tons in 1975. ("Suisan Tsushin," May 23, 1973.)

JAPANESE ELVER IMPORTS FROM MAINLAND CHINA TO INCREASE

The increasing production of cultured eels in Japan to meet the growing domestic demand has put elvers in short supply in that country. The Japanese consumption demand for eels is about 30,000 metric tons annually. In 1970, the domestic supply of matured eels totaled about 20,000 tons (17,000 tons of cultured and 3,000 tons of native eels), and imports from South Korea and Taiwan recorded about 5,000 tons. The domestic elver supply in 1970 was 41 metric tons and imports totaled 213 tons. To supplement the dwindling domestic elver supply, the Japanese are actively seeking foreign sources. Live young eels are being air-freighted from Spain, and until recently shipments were also regularly coming from South Korea and Taiwan.

In early 1973, however, South Korea put an export ban on elvers to protect the resources, and Taiwan from this year began prohibiting their exports until July. Thus, the Japanese began focusing attention on imports from the People's Republic of China. One trading firm, Maruichi Shoji, which has been importing young eels from that country in recent years, in April and May this year successfully shipped 170 kilograms from Shanghai to Nagasaki in two shipments aboard the new freighter, "Taisei Maru No. 8" (300 gross tons) at the import price of 160-170,000 yen per kilogram (approx. US $274-292 a pound). For the first time, no die-offs occurred during the 47-hour journey. Because of improvement in shipping technique, as well as better capturing methods developed in mainland China, elver imports from that country in 1973 is expected to sharply increase. The eels from China are of the species *Anguilla japonica*, the same as that which occurs in Japan. ("Minato Shimbun," May 18, 1973 & other sources.)

JAPANESE EXPERIENCE GOOD SQUID FISHING OFF NEW ZEALAND

A fleet of 69 large Japanese squid vessels, which fished off New Zealand for about 60 days, terminated operations in early March this year with a fleet catch of 14,300 metric tons. The catch surpassed the goal of 12,000 tons. In terms of cases, the production was 1.69 million cases (8.5 kilograms/case), which was considered generally good, with high boats producing 42,000 cases and even the low boats recording 20,000 cases. The average catch per day of fishing was 3,000 cases. The fishing expedition is reported to have confirmed that the squid resource off New Zealand is not in a dangerous state and that the potential is promising. The Japanese are planning to send squid vessels to that region again at the end of the year. The squid are packed for tuna bait as well as for human consumption. The producers are selling the edible squid in Japan at the price of 1,000-1,200 yen (US $3.78-4.53) per case and the bait squid at 1,300-1,500 yen ($4.90-5.66) per 8-kilogram case (packed 35 to the case). ("Katsun-maguro Tsushin," May 21 and "Minato Shimbun," May 17, 1973.)

Source: Summarized from the Japanese press by James H. Shohara.

FREEZE ON CANADIAN SCALLOP FISHING

Halifax, N.S.—A freeze on Canada's east coast offshore scallop fishing fleet and a limit on the size of scallops taken in the fishery went into effect June 1, the federal Fisheries and Marine Service announced today. Both measures are intended to protect valuable scallop resources concentrated on Georges Bank south of Nova Scotia. Fishing industry representatives and vessel owners have been consulted on plans for their implementation.

No new vessels will be permitted entry into the scallop fishery. The fleet now totals 72 vessels, 15 of which are new entrants within the past two years. There has been marked increase in interest in the fishery following a rapid rise in scallop prices. In one area prices jumped from $1.09 per pound in 1970 to $1.75 this year.

Size restrictions on scallop catches are set at a maximum of 60 "meats per pound" (the number of scallops needed to yield one pound of scallop meat).

Introduction of these measures is in conformity with commitments made by Canada to the International Commission for the Northwest Atlantic Fisheries.

Source: News Release, Environment Canada

Korean Oyster Culture Studied

A team of four oyster specialists from Hiroshima Prefecture—one of Japan's major oyster culture sites—recently concluded a study of oyster culture in the Republic of Korea (ROK). They made the following observations:

(1) Longline culture accounts for 75 percent of all oyster cultured in the ROK and raft culture 25 percent.

(2) At the present time only 2,760 hectares are used for oyster culture, but plans are being made to expand this area to 26,151 hectares in the near future.

(3) Oyster culture technology in the ROK is just as advanced as in Hiroshima Prefecture.

(4) Spawning occurs one month earlier in the ROK than in Hiroshima Prefecture, thus giving ROK oyster producers a marketing advantage.

(5) The price for oysters, for canning, is US $0.18 to $0.21/lb, slightly below the Japanese price of $0.26/lb.

(6) Wages paid to Korean women workers range between $0.07 to $0.08 per hour, or one-tenth the price for Japanese workers.

(7) Korean oyster production in 1972 was 11,700 metric tons, or 43 percent of the 27,000 tons harvested in Hiroshima Prefecture during fiscal year 1971 (April 1971-March 1972).

(8) ROK production plans call for harvesting 15,000 tons in 1973, and 30,000 tons in the next two or three years, which will exceed Hiroshima's total production.

("Suisan Keizai," April 23, 1973)

Source: NMFS International Activities Staff.

CANADIANS MAY CLOSE EAST COAST PORTS

Ottawa.—A special study is to be made into the possible effects of closing Canadian East Coast ports to foreign fishing fleets.

Fisheries Minister Jack Davis has asked Dr. Ernest P. Weeks of Ottawa, Chairman of the Canadian Saltfish Corporation, to carry out the study. His main task will be to assess the economic consequences of port closures upon Canadian merchants on the one hand and the Canadian fishing industry on the other.

"Our own fishermen have been asking us to close our ports to foreigners, especially those who fish indiscriminately near our shores", Mr. Davis said. "Two-thirds of all the fish caught in the North Atlantic are taken by foreign fishermen. Their big fleets are heavily subsidized. They'll be even more costly if they can't get into our ports to buy supplies and make repairs. Closing them, or even the threat of closing them, may cause them to back off our Shelf".

Vessels from fifteen countries fish regularly in the Northwest Atlantic. They frequently call in at St. John's, Newfoundland and Halifax, Nova Scotia. Occasionally they also call in at Sydney, N.S. as well.

Source: News Release, Environment Canada.

Publications

WORLD FISHERIES EXAMINED IN NEW BOOK

"World fisheries policy: multidisciplinary views," a book in which 16 distinguished scientists, economists, and government and United Nations officials evaluate the effectiveness of past fisheries policy and outline the concepts and attitudes that will shape the policy of the future, has been published by the University of Washington Press. The book was edited by Brian J. Rothschild, Director, NMFS Southwest Fishery Center, La Jolla, California, and Honolulu, Hawaii.

Several present and past members of the NMFS staff contributed to the volume, which is the sixth of a series of University of Washington books on Public Policy Issues in Resource Management. The NMFS contributors are:

Dayton L. Alverson, Director, NMFS Northwest Fisheries Center, Seattle, "Sciences and fisheries management;"

John C. Marr, Program Leader, United Nations Development Program/Food and Agriculture Organization's Indian Ocean Program, "Indian Ocean fishery development;" the drift from the goal of maximum sustained yield to more complex social-welfare goals; and the necessity of evolving new methods of fishery management, which will utilize systems analysis and computer technology. The price of the book is $9.50.

J. L. McHugh, Professor of Marine Resources, Marine Sciences Research Center, State University of New York, Stony Brook, "Jeffersonian democracy and the fisheries;"

Donald L. McKernan, Coordinator of Ocean Affairs, Department of State and Special Assistant to the Secretary of State for Fisheries and Wildlife, "World fisheries—world concern;"

Brian J. Rothschild, "Introduction," and "The need for analysis in the development of United States fisheries policy;"

William F. Royce, Associate Director for Research, NMFS, "The gap between theory and policy in fishery development;" and

The late William M. Terry, at the time of his death Director of International Affairs, NOAA, "Fisheries and the national interest."

Areas discussed in the book include territorial conflicts; the needs and desires of developing countries; the question of whether existing regional conventions can assure adequate conservation and equitable allocation of catches in today's fisheries.

RECENT NMFS SCIENTIFIC PUBLICATIONS

NOAA Technical Report NMFS CIRC-371. Sokoloski, Adam A. (editor) **"Ocean fishery management: discussions and research."** April 1973. 173 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: $1.50.

(No abstract)

NOAA Technical Report NMFS CIRC-374. Cook, David G., and Ralph O. Brinkhurst. **"Marine flora and fauna of the Northeastern United States. Annelida: Oligochaeta."** May 1973. 23 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: 35 cents.

ABSTRACT

The manual includes an introduction on the general biology, an illustrated key, an annotated systematic list, a selected bibliography, an an index to the marine Oligochaeta of the East Coast of North America. The Families Naididae, Tubificidae, Enchytraeidae, and Megascolecidae are treated.

NOAA Technical Report NMFS CIRC-379. Thorson, Lee C., and Mary Ellen Engett. **"Fishery publications, calendar year 1969: lists and indexes."** April 1973. 31 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: 45 cents.

ABSTRACT

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration (until October 1970 the Bureau of Commercial Fisheries of the U.S. Fish and Wildlife Service) in calendar year 1969 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: Circular, Data Report, Fishery Industrial Research, Fishery Leaflet, and Special Scientific Report—Fisheries.

NOAA Technical Report NMFS CIRC-380. Engett, Mary Ellen, and Lee C. Thorson. **"Fishery publications, calendar year 1968: lists and indexes."** May 1973. 24 p. For Sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: 35 cents.

ABSTRACT

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration (until October, 1970 the Bureau of Commercial Fisheries of the U.S. Fish and Wildlife Service) in calendar year 1968 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: Circular, Data Report, Fishery Industrial Research, Fishery Leaflet, and Special Scientific Report —Fisheries.

Monthly Fishery Market Review

Groundfish Supplies up in April

Total supplies of groundfish during April were considerably higher than a year ago, with substantial gains in imports and heavier beginning inventories. Particularly strong demand during the month contributed to higher wholesale and retail prices.

Supplies of blocks generally declined during the month as imports continued to be below a year earlier. With lower supplies and increasing demand from stick and portions producers, block prices increased across the board. Inventories of sticks and portions fell during the month and prices increased.

Supplies of shellfish were greater during April than in the same month in 1972. Demand appeared relatively strong as inventories generally fell. Prices for spiny lobster and shrimp rose while scallops and American lobster prices declined.

The cumulative picture for January through April for groundfish fillets shows total supplies up 13 percent, consumption up 1 percent and inventories on April 30 more than double what they were a year ago. Price changes were mixed according to species, with increases generally ranging between 10 percent and 40 percent.

Block imports for January-April were 28 percent below a year ago, consumption increased slightly and end-of-period inventories dropped 37 percent compared with a year earlier. From January 1 to April 30, inventories of block were reduced by 43 million pounds. During the same period last year, the net drawdown was 9 million pounds.

January-April results for shellfish showed heavier total supplies for all major species, compared with a year ago, due chiefly to heavy carryover inventories. U.S. landings of shrimp, scallops, and American lobster were substantially higher than a year earlier. There were declines in shrimp and spiny lobster imports, but imports of scallops and American lobster were heavier. Consumption of all major shellfish increased significantly.

GROUNDFISH

Domestic groundfish landings in April were 45 percent below the previous year, and the total for the year through April was down 16 percent (Table 1). Heavy April imports more than offset the decline in landings. For January through April, haddock imports were 56 percent higher than a year ago, cod 12 percent higher. Flounder imports moved up 48 percent, but imports of ocean perch dropped about 20 percent. For April the combination of a 24 percent increase in imports and an 87 percent gain in beginning inventories resulted in a 41 percent rise in the quantity available for consumption. During

Table 1.—Groundfish (fillet weight, in million pounds) supplies, April 1973. Groundfish include cod, flounder, haddock, and ocean perch.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change 1972-73	JAN-APR 1973	JAN-APR 1972	Percent Change 1972-73
	---Million Pounds---				Percent	---Million Pounds---		Percent
Beginning Inventory	50.8	44.4	34.8	18.6	+ 87	52.4	45.0	+ 16
Landings, Total	3.8	5.5	3.2	5.8	- 45	17.5	20.8	- 16
Imports	16.5	24.8	25.5	20.5	+ 24	88.8	74.5	+ 19
Total Supply	71.1	74.7	63.5	44.9	+ 41	158.7	140.3	+ 13
Ending Inventory	44.4	34.8	31.6	14.2	+123	31.6	14.2	+123
Consumption	26.7	39.9	31.9	30.7	+ 4	127.1	126.1	+ 1

Table 2.—Groundfish prices, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change 1972-1973	JAN-APR 1973	JAN-APR 1973	Percent Change 1972-1973
	---Cents Per Pound---				Percent	Cents Per Pound		Percent
COD:								
Ex-vessel[1]	24.7	24.3	20.0	18.3	+ 9	23.3	22.7	+ 3
Wholesale -								
1 lb. Canadian	57.0	57.9	61.5	56.0	+10	58.3	54.0	+ 8
5 lb. Canadian	51.4	53.3	58.0	56.0	+ 4	53.0	52.9	-
Retail[2]	179.5	184.5	184.0	131.5	+40	183.4	134.7	+36
FLOUNDER:								
Ex-vessel[3]								
Yellowtail	34.91	28.85	32.37	19.62	+65	28.45	20.60	+38
Lemonsole	56.00	53.15	44.00	36.78	+20	50.09	43.29	+16
Greysole	37.71	36.30	29.40	20.41	+44	34.09	26.56	+28
Blackback	35.10	32.15	30.05	19.29	+56	31.28	26.92	+16
Wholesale -								
5 lb. domestic	92.5	97.5	111.3	88.8	+25	98.1	85.8	+14
5 lb. Canadian	77.8	79.1	80.5	58.0	+39	78.9	55.5	+42
Retail[2]	204.0	225.7	236.6	167.8	+41	212.2	160.3	+32
HADDOCK:								
Ex-vessel[1]								
Large	44.4	47.10	49.7	41.5	+20	46.4	42.4	+ 9
Scrod	28.7	27.16	32.5	33.3	- 2	28.5	34.8	-19
Wholesale								
5 lb. Canadian	77.5	78.0	79.5	59.5	+34	78.1	59.2	+32
Retail[4]	119.6	120.8	124.2	103.4	+20	120.1	102.9	+17
OCEAN PERCH:								
Ex-vessel[1]	7.2	7.2	7.6	5.4	+41	7.6	5.3	+43
Wholesale -								
5 lb. domestic	56.5	60.8	61.5	38.8	+59	58.6	36.0	+63
5 lb. Canadian	51.5	53.6	54.3	38.6	+41	52.4	36.6	+43
Retail[4]	90.3	91.8	94.4	73.1	+29	91.0	73.2	+24

[1] Quotes taken at Boston, Mass.
[2] New York Consumer Market Reports.
[3] New Bedford, Mass.
[4] Bureau of Labor Statistics — average of 36 U.S. cities.
NOTE: All wholesale prices—f.o.b. Boston, Gloucester, and New Bedford.

January-April, total supplies were 159 million pounds, compared with 140 million pounds a year earlier.

Although above the previous year, ex-vessel prices for cod, and flounder were below the previous month in April in spite of lower landings (Table 2). Haddock and ocean perch ex-vessel prices were up an average of 10 and 6 percent, respectively. Wholesale and retail prices were well above the previous month and year for cod, haddock, flounder, and ocean perch.

Consumption of groundfish in April was 4 percent above the previous year, with gains in cod, flounder, and haddock. Ocean perch was off somewhat. Consumption for January-April was 1 percent higher than a year earlier.

BLOCKS, STICKS AND PORTIONS

Supplies of fish blocks in April this year were well below a year ago, as both imports and beginning inventories were off sharply (Table 3). April imports of blocks totaled 29 million pounds—down 36 percent from a year earlier. This decline represented the fourth consecutive month that imports have been below the previous year and this has put a severe crimp on available supplies. As a result of the recent reduction in imports, producers of sticks and portions have had to rely on inventories to support production. Inventories have accordingly declined approximately 43 million pounds since the beginning of the year.

With the production needs of stick and portion producers increasing and supplies becoming more tight, prices of blocks have steadily risen throughout the year (Table 4). Wholesale prices in May were above the previous year for each species as cod and ocean perch led the way with gains of 32 and 39 percent, respectively.

Sticks and portions mirrored the block situation with declining inventories (Table 5) and generally higher prices (Table 6). Inventories have fallen about 30 percent since the beginning of the year while prices have increased from 2 to 12 percent from April, 1972.

SHRIMP

Because of high inventories at the start of the month, supplies of shrimp during April were 9 percent above the previous year. Unlike March, however, domestic landings, as well as imports, were below year ago levels (Tables 7 and 8). The Pacific shrimp catch, which had been supporting the overall increase in U.S. landings, declined about 75 percent from the previous month to a quantity estimated to be equal to the low catch in April 1972. Imports of shrimp again declined as the Japanese apparently have provided a good deal of competition for U.S. importers. Domestic exports continue to be well above the previous year as the Japanese have reportedly purchased substantial quantities of shrimp on the U.S. market.

During January-April, the U.S. Pacific shrimp were predominant in the

Table 3.—Blocks and slabs, supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	- - -Million Pounds- - -				*Percent*	*- - Million Pounds- -*		*Percent*
Beginning Inventory	62.4	48.6	41.2	49.8	− 17	75.8	62.7	+ 21
Production	0.6	0.4	0.2	0.1	+100	1.5	0.6	+150
Imports	17.0	30.2	18.7	29.0	− 36	82.7	114.2	− 28
Total Supply	80.0	79.3	60.1	78.9	− 24	160.0	177.5	− 10
Ending Inventory	48.6	41.2	32.6	51.8	− 37	32.6	51.8	− 37
Consumption	31.4	33.3	27.5	27.1	+ 1	127.4	125.7	+ 1

Table 4.—Blocks and slabs, prices, April 1973. Wholesale prices of blocks f.o.b. primary wholesaler — Boston, Gloucester, and New Bedford, Mass.

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
		- - -Cents Per Pound- - -											
Cod	1972	46.5	47.0	47.0	47.0	45.6	46.5	47.0	47.0	47.0	47.0	47.0	48.0
	1973	48.6	52.4	56.6	58.5	60.0							
Flounder	1972	43.5	44.4	45.3	49.2	51.7	53.3	55.6	57.0	58.0	58.0	58.7	59.5
	1973	59.5	59.6	60.0	60.0	60.0							
Haddock	1972	47.1	47.5	47.5	47.9	50.3	52.8	54.4	57.0	58.1	59.5	59.5	59.5
	1973	60.1	60.5	61.4	63.3	64.5							
Ocean Perch	1972	38.5	38.5	38.7	39.5	39.5	39.8	41.6	45.0	48.0	48.3	49.4	49.0
	1973	51.2	53.1	53.9	54.0	55.0							
Pollock	1972	32.3	32.0	32.0	32.1	31.2	31.5	31.5	31.0	29.6	29.5	28.3	28.0
	1973	29.0	30.1	33.0	34.0	34.3							
Whiting	1972	33.0	33.5	33.0	33.0	33.2	31.5	31.5	31.5	31.5	32.0	34.1	34.0
	1973	34.6	35.8	37.5	37.5	37.5							
Wolffish	1972	49.3	50.0	50.0	50.0	50.3	50.5	51.0	51.5	51.3	51.0	51.0	51.0
	1973	51.0	50.0	54.5	52.0	52.0							

Table 5.—Sticks and portions, supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	- - -Million Pounds- - -			*Percent*	*- - -Million Pounds- - -*			*Percent*
Beginning Inventory	34.9	32.0	25.8	17.3	+49	34.4	23.2	+48
Production:								
Sticks	12.3	14.2	N.A.	10.2	N.A.	N.A.	43.1	N.A.
Portions	22.6	26.7	N.A.	23.6	N.A.	N.A.	88.6	N.A.
Total	34.9	40.9	N.A.	33.8	N.A.	N.A.	131.7	N.A.
Imports	0.1	0.2	0.2	0.1	+100	0.6	0.3	+100
Total Supply	69.9	73.1	N.A.	51.2	N.A.	N.A.	155.2	N.A.
Ending Inventory	32.0	25.8	24.4	16.1	+52	24.4	16.1	+52
Consumption	37.9	47.3	N.A.	35.1	N.A.	N.A.	139.1	N.A.

Table 6.—Sticks and portions, weekly average wholesale prices, April 1973.

Item	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change
	- - - -Cents Per Pound- -				
Cod portions	62.0	64.5	67.0	59.6	+12
Haddock	70.0	69.5	69.5	64.3	+ 8
Cod sticks	78.0	78.0	78.0	76.0	+ 3
Haddock sticks	79.7	79.7	79.7	78.2	+ 2

domestic catch and landings from this area were double a year earlier. Overall, the January-April shrimp catch was up 11 percent from 1972. The landing season for Gulf shrimp begins in May and this will be the principal source of domestic shrimp for the remainder of the year. Imports during January-April were down 3 percent. Demand was strong enough during the period to cause an unusually heavy drain on inventories, which dropped from 93 million pounds on January 1 to 59 million pounds on April 30. Consumption for the period was up 14 percent compared with last year.

SCALLOPS

Supplies of scallops in April continued to be well above the previous year (Tables 9 and 10). The increase amounted to 87 percent, the result of higher beginning inventories, landings, and imports. For January through April, total supplies of scallops were 58 percent above a year earlier. The declining trend in ex-vessel and wholesale prices, begun in October, 1972, continued through April with declines of 10 percent and 2 percent, respectively. Retail prices, however, were 30 percent above the previous year.

Apparently in response to lower prices and improved supplies, consumption has consistently been above year-earlier totals. The April increase in consumption moderated somewhat from the previous month, but it was still 30 percent above the quantity consumed a year earlier. Consumption for January-April was 9 million pounds, compared with 6.5 million pounds a year earlier.

AMERICAN LOBSTER

April supplies of American lobsters were 23 percent above 1972 as a result of gains in both landings and imports (Table 11). Maine landings were 16 percent above April, 1972, and the January-April total was 66 percent above a year earlier. After being down during the first two months of the year, imports have recovered to post gains of 65 percent in March and 25 percent in April for an overall increase of 2 percent during the January-April period. Prices were again below the previous year, although not as much as in March (Table 12). Ex-vessel prices were down 5 percent while wholesale prices were 7 to 9 percent below 1972 except 1½ and 2 pound lobsters, which registered gains.

SPINY LOBSTERS

Spiny lobster tail supplies in April were well above last year as a result of substantially heavier beginning inventories (Table 13). Imports in April dropped again with higher shipments from Australia, Brazil, and New Zealand. Only South Africa showed a gain

Table 7.—Shrimp supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	--Million Pounds--				Percent	--Million Pounds--		Percent
Beginning Inventory:	82.7	79.2	69.2	58.5	+ 18	92.7	69.9	+ 33
Landings:								
Total	12.0	12.7	6.3	7.7	- 18	44.7	40.1	+ 11
Gulf	4.1	4.2	4.0	4.5	- 11	17.6	22.4	- 21
Northeast	2.2	3.1	.9	1.6	- 44	8.4	7.7	+ 9
Pacific	5.6	5.4	1.4[1]	1.4	-	18.3	9.3	+ 97
South Atlantic	.1	-	-	.2	-	.4	.7	- 43
Imports	16.8	16.3	17.0	18.3	- 7	68.5	70.5	- 3
Total Supply	111.5	108.2	92.5	84.5	+ 9	205.9	180.5	+ 14
Ending Inventory	79.2	69.2	58.7	56.9	+ 3	58.7	56.9	+ 3
Exports:								
Total	4.9	6.6	5.5[1]	3.5	+ 57	21.5	13.4	+ 60
Domestic Fresh & Frozen	3.6	4.9	3.9[1]	2.8	+ 39	16.1	11.4	+ 41
Transshipments	1.3	1.7	1.6[1]	.7	+129	5.4	2.0	+170
Gulf Canned Pack Fresh & Frozen	.4	-	-	-	-	.9	.9	-
Consumption	27.0	32.4	28.3	24.1	+17	124.8	109.3	+14

[1]Estimated

Table 9.—Scallop supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	--Thousand Pounds--				Percent	--Thousand Pounds--		Percent
Beginning Inventory	3,870	3,418	2,869	1,066	+169	3,736	1,585	+136
Landings, Total	618[1]	571[1]	650[1]	622	+ 4	2,210	2,027	+ 9
Imports	1,058	1,995	1,370	927	+ 48	5,785	3,835	+ 51
Total Supply	5,546	5,984	4,889	2,615	+ 87	11,731	7,447	+ 58
Ending Inventory	3,418	2,869	2,714	946	+187	2,714	946	+187
Consumption	2,128	3,115	2,175	1,669	+ 30	9,017	6,501	+ 39

[1]Estimated

Table 11.—American lobster supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	------Thousand Pounds------				Percent	Thousand	Pounds	Percent
Maine Landings	174	149	317	273	+16	1,048	633	+66
Imports	1,055	1,606	1,493	1,195	+25	6,156	6,027	+ 2
Consumption	1,229	1,755	1,810	1,468	+23	7,204	6,660	+ 8

Table 13.—Spiny lobster tails, supplies, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change	JAN-APR 1973	JAN-APR 1972	Percent Change
	--Million Pounds--				Percent	--Million Pounds--		Percent
Beginning Inventory	8.3	7.8	8.0	5.2	+54	8.9	4.7	+89
Imports	3.3	3.7	2.4	3.3	-17	12.2	14.2	-14
Total Supply	11.6	11.5	10.4	8.7	+20	21.1	18.9	+12
Ending Inventory	7.8	8.0	7.5	6.4	+17	7.5	6.4	+17
Consumption	3.8	3.5	2.9	2.3	+26	13 6	12.5	+ 9

from the extremely low level in 1972. For January-April, total supplies were up 12 percent.

Wholesale prices were somewhat mixed during the month (Table 14). Cold-water tails registered a 6 percent gain but warm-water tails were off 14 percent. Apparent consumption of 2.9 million pounds was 26 percent above April, 1972, and 9 percent above the cumulative total for the first 4 months of the year.

Table 8.—Shrimp prices, April 1973.

Item	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change
	----Dollars Per Pound----				
Ex-vessel:					
15-20 count	$1.88	$1.98	$2.06	$2.07	-
31-35	1.70	1.76	1.81	1.38	+31
51-65	1.10	1.26	1.35	.90	+50
Wholesale:					
15.20 count	2.00	2.12	2.19	2.34	- 6
31-35	1.80	1.89	1.95	1.74	+12
51-65	1.20	1.32	1.51	1.09	+38
Retail:					
15-20 count	2.84	3.06	3.05	3.02	+ 1
31-42	2.09	2.29	2.26	2.14	+ 6

Table 10.—Scallop prices, April 1973.

Item	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change
	---Dollars Per Pound---				
Ex-vessel	$2.03	$1.96	$1.76	$1.86	- 5
Wholesale	2.44	2.25	2.22	2.23	-
Retail	3.24	3.19	3.23	2.48	+30

Table 12.—American lobster prices, April 1973.

	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change
	--Dollars Per Pound--				
Ex-vessel	$1.89	$1.78	$1.43	$1.50	- 5
Wholesale:					
1-¼ lb.	$2.63	$2.49	$2.06	$2.21	- 7
1-½	2.79	2.88	2.55	2.30	+11
1-⅛	2.56	2.47	2.00	2.20	- 9
2	2.92	3.10	2.83	2.40	+18
chix	2.50	2.42	1.99	2.14	- 7

Table 14.—Spiny lobster tails, wholesale prices, April 1973.

Item	FEB 1973	MAR 1973	APR 1973	APR 1972	Percent Change
	--Dollars Per Pound--				
6-8 oz. tail					
Cold-water	$4.40	$4.56	$4.64	$4.38	+6
Warm-water	3.17	3.30	3.33	3.89	+14

Reading Matter

• The four publications mentioned under "Recent NMFS Scientific Publications" seem to deserve more extended notice than can be given under the bald listing on page 44. Each represents the fruition of a long-planned publishing project. All are for sale by the Superintendent of Documents, by the way.

• "Ocean Fishery Management: Discussions and Research" contains the papers contributed to a NMFS workshop held late in 1970. Attending the workshop were "virtually all known researchers in Fishery Economics throughout the world, many administrators, and researchers in related disciplines," according to Adam A. Sokoloski, the editor of the publication. Now associated with the Environmental Protection Agency, Sokoloski was at that time a member of the NMFS staff. As Sokoloski says in his preface, "Until recent years only biological or technical aspects of fisheries conservation have advanced beyond esoteric professional journals or smoke-filled back rooms to be given serious consideration when formulating working management programs. In recent years the social sciences, especially economics with its emphasis on rational management, have gained some respectability beyond mere conceptual discussion.

"With the mounting urgency of fishery management problems serving as a catalyst, the National Marine Fisheries Service has multiplied its research in this area, aided in part by the rapidly growing Sea Grant program." This volume is one of the results of that research.

Sokoloski leads off the 173-page volume with a paper, "The status of fisheries management research: an overview." The remaining papers are classified under three topics: "Issues in fishery management," "Production functions and bioeconomic models: research implications," and "Issues related to fishery management: research results." The range of topics treated is wide.

"Ocean Fishery Management: Discussions and Research" is not, on the whole, easy reading. The authors are specialists writing for specialists. But it is a document worth spending some time on, for it, like other publications appearing these days, reflects the emerging recognition that disciplines other than fishery biology should be brought more strongly to bear on fishery problems.

• "Marine Flora and Fauna of the Northeastern United States. Annelida: Oligochaeta," by David S. Cook and Ralph O. Brinkhurst is a slim pamphlet that is the first in a series of publications designed to provide biology students, biologists, biological oceanographers, informed laymen and others with authoritative manuals enabling them to identify coastal organisms of the northeastern United States. Each manual (several dozen are planned) will be based on recent systematic research and fresh examination of the plants and animals and each will be prepared by an authority on the topic. All will be copiously illustrated.

Preparation of "Marine Flora and Fauna of the Northeastern United States" is being coordinated by a board headed by Melbourne R. Carriker, who recently has become a member of the faculty of the University of Delaware, after some years as head of the Systematics-Ecology Program of the famous Marine Biological Laboratory, Woods Hole, Mass.

The Cook and Brinkhurst publication is a comprehensive key to marine Oligochaeta from New England to Cape Hatteras. According to *Marine Fisheries Review* staff member Mary Ellen Engett, "Oligochaeta is a scientific name for certain types of worms; the word itself is derived from two Greek words: *oligo*, meaning small, and *chaité*, meaning mane. Each segment of these worms (except for a portion of the head) contains four bundles of setae or hairs—hence the name.

"The aquatic Oligochaeta are smaller and simpler in structure than the common earthworm, a terrestrial oligochaete. Since the marine species live on the botton, their survival depends on the availability of suitable substrates and their ability to compete with other water deposit feeders in a given habitat. They seem to have little trouble surviving in polluted areas, however: during one study in the San Francisco Bay system, 97.8 percent of the total bottom fauna contained Tubificidae (an Oligochaeta species). The scientists who conducted this study believe that changes in abundance of certain species may indicate the nature and source of pollution materials."

David G. Cook is affiliated with the National Museum of Natural Science, Ottawa, Canada and the Systematics-Ecological Program of the Marine Biological Laboratory. Ralph O. Brinkhurst is associated with the Department of Zoology, University of Toronto, Canada and the Systematics-Ecology Program. His work on the aquatic oligochaetes of New England was supported by the Ford Foundation and National Science Foundation.

In all, a great deal of learning and information for the small sum of 35 cents, the cost of this first manual in the series. Five more are in press.

• Finally, NMFS scientific publications for the calendar years 1968 and 1969 are listed and indexed in the two publications by Lee C. Thorson and Mary Ellen Engett. They have four more such publications in press, covering the years 1965, 1966, 1967, and 1972 (lists for 1970 and 1971 have previously appeared). When the publications in press appear, there will be in existence detailed lists and subject indexes of all scientific publications of NMFS (and its predecessor agencies) from 1920 through 1972.

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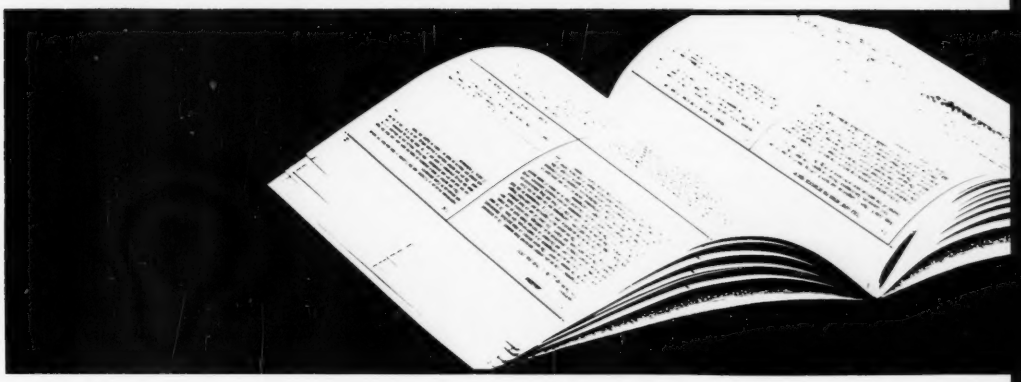
MARINE FISHERIES ABSTRACTS



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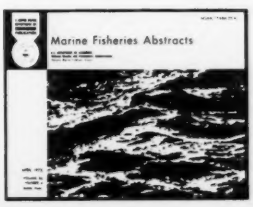

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